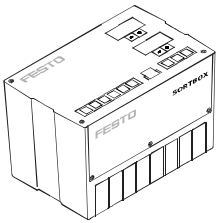
The Checkbox family

FESTO

Manual
Checkbox

Identbox
Countbox
Sortbox



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Designated use

The Checkbox has been designed for use in manual and industrial applications in enclosed work rooms under normal operating conditions.

The Checkbox described in this manual is intended exclusively for use as follows:

– for sorting and rejecting small conveyed parts such as e.g. screws, springs, bolts.

– for contact-free checking of the position and quality of the parts.

Use the Checkbox only as follows:

– in accordance with designated use

– in faultless technical condition

– without any modifications by the user.

No guarantee claims can be accepted if the device is opened.

The specified limits for pressure, temperature, electrical connections etc. must be observed.

Please observe the standards specified in the relevant chapters and comply with technical regulations, as well as with national and local regulations.

Operating requirements

– The features of the conveyed part which determine the orientation or quality must be recognizable and distinguishable for the Checkbox.

– It must be possible to integrate the conveyor unit in the material flow.

Target group

This manual is intended exclusively for technicians trained in control and automation technology, who have experience in installing and commissioning electrical systems.

Service

Please consult your local Festo service centre if you have any technical problems.

Scope of delivery

Checkbox	Conveyor unit – with conveyor belt or tunnel variant and integrated line camera control unit with operating panel and I/O interfaces.
Documentation	Description of the Checkbox
Software	CheckKon (function: observe system) including diagnostic cable
Accessories	– Compressed air tubing with coupling plug and screw connector – Hybrid connecting cable for control unit/conveyor unit with two Harting connectors – 5-pin connector for the conveyor unit.

- 2 configurable (blanking) plugs:
  - 4-pin round plug for connecting “sensors”
    Wired at the factory:
    Operation without buffer zone sensors i.e. sensor inputs 1...2 wired with reference voltage
  - 37-pin sub-D plug for connecting the “controller”
    Wired at the factory:
    Internal power supply of the I/O module.
    Operation without buffer zone sensors i.e. sensor inputs 3...6 wired with reference voltage (Sortbox).

A summary of additional accessories available can be found in chapter A.6.

Important user instructions

Danger categories

This manual contains instructions on the possible dangers which may occur if the product is not used correctly. These instructions are marked (Warning, Caution, etc.), printed on a shaded background andmarked additionally with a pictogram. A distinction is made between the following danger warnings:

Warning
This means that failure to observe this instruction may result in serious personal injury or damage to property.

Caution
This means that failure to observe this instruction may result in personal injury or damage to property.

Please note
This means that failure to observe this instruction may result in damage to property.

The following pictogram marks passages in the text which describe activities with electrostatically sensitive components.

Electrostatically sensitive components may be damaged if they are not handled correctly.

Marking special information

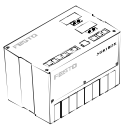
The following pictograms mark passages in the text containing special information.

Pictograms

Information
Recommendations, tips and references to other sources of information.

Accessories
Information about suitable accessories.

Environment
Sections dealing with environmetal aspects.



Identbox, Countbox, Sortbox
Information which only applies to a certain design of Checkbox (Identbox, Countbox or Sortbox).

Text markings

- The bullet indicates activities which may be carried out in any order.

1. Figures indicate activities which must be carried out in the sequence shown from top to bottom.

– Hyphens indicate general activities.

Conventions

– Operating and display components of the controller are represented in the text in upper-case letters e.g. TYPE SELECT, TOLERANCE. Supplementary details are shown in square brackets.
  Example: TYPE SELECT [1] indicates the luminous button 1 of the button group TYPE SELECT.

– Inputs and outputs of the plug connectors are specified with the pin number as follows:
  Input pin 1 I/1
  Output pin 2 O/2

– Plug connectors are shown viewed towards the device. This representation corresponds to the view (from the cable side) of the connections to be wired.

Notes on this manual

This manual refers to the standard design of Identbox, Countbox or Sortbox with operating system version 3.x.

When the Checkbox is switched on, the version number of the operating system will be shown briefly on the TOLERANCE display.

The options and parameters available depend on the operating system, the type of Checkbox connected and the pre-settings made at the factory. Special customer-specific designs may differ in technical data, parameter settings and functionality.

The pre-setting of the Checkbox can be modified if required with the software packages CheckKon (function “Modify system”) or CheckOpti available as options. Further information on the software packages can be found in the manuals listed under “Documentation on the Checkbox family.”

Documentation on the Checkbox family

Further information on using the Checkbox can be found in the following manuals:

Manual	Contents
User manual on the Checkbox family, type P.BE-Checkbox...	Description of the functioning, commissioning, operation and maintenance of the relevant Checkbox type: Identbox, Countbox and Sortbox
Description of the Checkbox configurator software package, type P.SW-CB-KONF-...	Operation of the CheckKon software package (Checkbox configurator)
Description of the Checkbox optimizer software package, type P.SW-CB-OPTI-...	Operation of the CheckOpti software package (Checkbox Optimizer)

Product-specific terms and abbreviations

Term/abbreviation	Meaning
Bad part	A test part on which at least one feature lies outside the tolerances.
C-value	The C-value indicates the extent of the scatter of the features of the sample parts.
Checkbox	Any device from the Checkbox family (e.g. Identbox, Countbox, Sortbox).
Feature	Characteristic features are ascertained from the contour data of the sample and test parts. These are, e.g. length, height etc., as well as a feature for each configuration tool (CheckOpti).
Good part	A test part on which all features lie within the tolerances.
Orientation	The parts to be checked by the Checkbox may lie facing in different directions on the conveyor belt. During the teach procedure, you define the orientations by showing the part in different directions. Orientation 1 is the preferred orientation (nominal orientation).
Parts type	Conveyed part defined by the teach data of the sample parts.
Sample parts	Parts shown during the teach procedure.

Term/abbreviation	Meaning
Scatter of features	The value range of a feature ascertained from several parts.
(System) parameter	Checkbox settings (in some cases settings can only be made with configuration software).
Teach data	All features ascertained during teaching, in each case with min./max. limits and average value.
Teach procedure	During the teach process, sample parts on the conveyor belt are shown to the Checkbox. This is also referred to as ”Teaching parts”.
Test data	The test data are the data used for the test. These correspond to the teach data plus the specified tolerances.
Test parts	Parts shown during the test process.
Test procedure	During the test procedure, test parts on the conveyor belt are shown to the Checkbox and classified according to their features with regard to orientation and observance of tolerances. This is also referred to as ”Testing parts”.
Tolerance	Factor in percent related to the average values which has an effect on the min./max. limits of all the features.

System summary

Chapter 1

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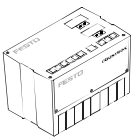
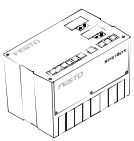
1.1 The Checkbox family

The devices in the Checkbox family permit the optical (contactless) positioning and quality check of conveyed parts. Variants of the Checkbox are available for this purpose, depending on requirements.

Device		Manual
	Identbox	Basic device with separate rejection of incorrectly orientated parts and bad parts
	Countbox	Functions as with Identbox plus: Counting of good parts with preselectable nominal amount
	Sortbox	Functions as with Countbox plus: simultaneous sorting and commissioning of several different conveyed parts

1.2 Software packages for the Checkbox

Various software packages are available for user-friendly commissioning, optimizing and monitoring of the products of the Checkbox family.

Software package	Functions
Checkbox configurator (CheckKon)	– Displaying and evaluating registered test parts – Display and protocoling the parts contour as well as the features derived from the contour. – Display of the light intensity registered by the camera. – Display and printout of the system configuration. – Displaying and modifying the system parameters. – Loading a new operating system into the Checkbox.
Checkbox optimizer (CheckOpti)	– Modifying the teach data independently of the Checkbox (offline). – Monitored checking of parts, display of the registered features. – Evaluation of the parts check with regard to reliability (evaluation). – Graphic representation of test run (deviation from test part or position). – Optimizing the parts check by manual adaption of the min./max. values of the teach data or by configuration tools. – Support in project planning, administration and documentation.
Checkbox statistics (CheckStat)	– Display, evaluation and printout of statistical data of the tested parts.

The software packages have been developed specially for the Checkbox family products and can be used with all the devices in the Checkbox family.

1.3 Scope of functions of the Checkbox

Functions of the Checkbox IB = Identbox, CB = Countbox, SB = Sortbox	**IB**	**CB**	**SB**
Quality check – Checking the quality, e.g. for shavings or burrs in the case of swivel and milling parts. – Machine sorting of faulty and foreign parts.	x	x	x
Position check (nominal orientation) – Position-orientated supply of good parts to the following machine. – Return of incorrectly orientated good parts to the small parts conveyor.	x	x	x
Check of buffer zone – Return of good parts when buffer zone is full. If supplied parts block all buffer zones for a long period, the small parts conveyor will switch off. – Checks of the position and of the buffer zone can be made at the same time.	x	x	x
Production count A continuous counter ascertains the sum of all the good parts. – Transport of defined amounts of components (1...10 million) by specifying a nominal number of good parts. – Nominal number freely selectable for each parts type.		x	x
Sorting – Simultaneous transport of different parts types from a small parts amount. – Sorting into different buffer zones.			x
Commissioning Putting together a parts assortment – Transport of defined amounts of components (1...10 million) by specifying a nominal number of good parts. – Nominal number freely selectable for each parts type.			x

1.4 Components of the Checkbox

1 Controller

2 Conveyor unit
Conveyor belt

3 Stop edge

4 Conveyor unit
camera housing

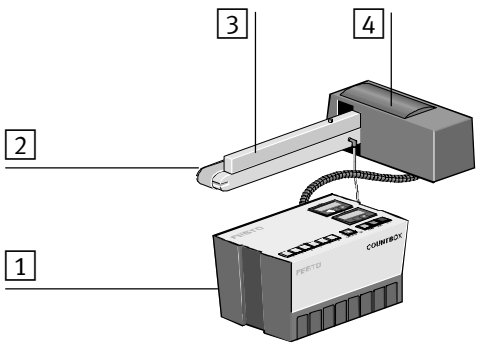


Fig. 1/1: Components of the Checkbox

The Checkbox consists of two compact modules:

The controller with control panel:

– I/O interfaces

– configurable test functions.

Conveyor unit with high-quality line camera, LED light strip and conveyor belt suitable for industrial use. An encoder can be fitted onto the conveyor unit. The variants of the conveyor unit are distinguished by the following:

– the maximum size of the conveyed part, the camera resolution

– the belt speed, the direction of movement of the belt

– the number of reject positions.

Further information on the various designs of conveyor unit can be found in the chapter A.5 “Technical specifications”.

1.5 Method of operation of the Checkbox

The method of operation of the Checkbox is based on

- the contactless recognition of small parts
- the teaching of new parts without programming
- an integrated quality check.

1 The rejection of incorrectly orientated parts

2 Rejection of faulty or foreign parts

3 Output of good parts via a buffer zone

4 Conveyor belt of the Chekbox

5 Small parts conveyor

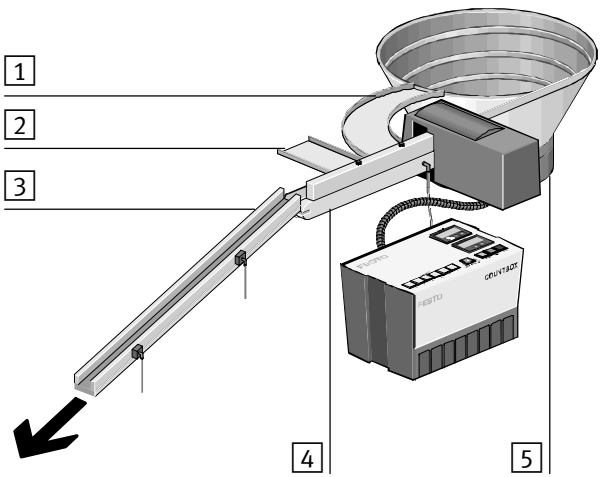


Fig. 1/2: Conveyor path (example)

Recognizing

A small parts conveyor (e.g. vibrator conveyor, centrifugal machine, stage conveyor) sorts out the conveyed parts and passes them on to the conveyor belt of the conveyor unit. The conveyor belt passes the parts between the line camera and the LED lighting. The camera registers each conveyed part in contour images. From the contours the system ascertains part-specific features such as the length, breadth and surface.

On the basis of the features, the Checkbox recognizes:

– the parts type

– the orientation

– the observance of dimensions

– the quality.

Learning

The nominal contour of a conveyed part type is ascertained by a simple procedure.

1. Addressing
   You select a memory location for the conveyed part type.

2. Scanning
   You “show” the camera several samples of this conveyed part type in the nominal orientation one after the other. If necessary, you then scan the sample parts in further orientations.

3. Saving
   At the end of the teaching process, you save the features of the parts type as the teach data under the memory address set.

Checking

Each conveyed part registered is compared with the saved teach data and separated according to the different types. The test parts are separated basically via three paths:

– Good parts are carried e.g. to an assembly plant.

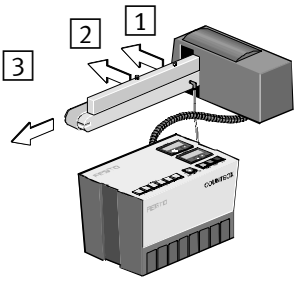
– Incorrectly orientated parts are returned to the small parts conveyor.

– Faulty or foreign parts are rejected.

The conveyor unit is fitted with at least two compressed air nozzles which blow conveyed parts down from the belt at certain positions. The remaining conveyed parts leave the belt at the end.

Standard delivery positions of the Checkbox

Identbox/Countbox

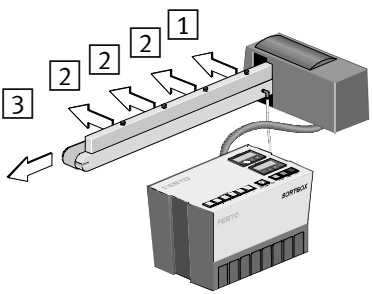


1 Blow down position for incorrectly orientated parts, superfluous parts or if parts are jammed.

2 Blow-down position for bad parts (faulty parts, foreign parts).

3 Delivery position for good parts, e.g. in the buffer zone of an assembly machine.

Sortbox



The Sortbox is fitted with 2, 4 or 6 compressed air nozzles depending on type for rejecting/blowing down parts.

1 Blow down position for incorrectly orientated parts, superfluous parts or if parts are jammed.

2 Blow-down position for different types of good parts.

3 Blow-down position for bad parts (faulty parts, foreign parts).

The standard configuration set at the factory determines the positions at which the tested parts leave the conveyor belt. The number and arrangement of the delivery positions can vary depending on the Checkbox version. The assignment of the positions can be modified with the CheckKon software (function “Modify system”).

1.6 Buffer zone

The buffer zone serves as a parts buffer for the following machine, e.g. assembly plant, and must be of such a size as to permit operation of the machine with as litttle interruption as possible. The Checkbox can monitor the status of fitted buffer zones by means of sensors and switches off the small parts conveyor, e.g. if it is overloaded.

Buffer zone sensors

Please note
When selecting the sensors, make sure that the sensor output has a potential of 24 V DC (normally-closed function) in the off position.
This ensures reliable operation of the supply system and prevents the system from becoming jammed, e.g. in the event of a cable fracture.

Signal delay

The buffer zone inputs are processed by the Checkbox with a debounce time. The sensor signal is only evaluated if it is present for at least 1 second. This delay prevents each conveyed part passing from triggering the signal “Buffer zone full” at the sensor.

The delay time of 1 second between the registering of a conveyed part by the sensor and the interpretation of the signal by the Checkbox must be taken into account whene the buffer zone sections are planned.

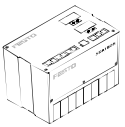
CheckKon
With the CheckKon software you can modify the following settings of the buffer zones.

– Switching logic (buffer zone sensor type = normally open/ closed).

– Signal delay (minimum sensor signal duration for status “Buffer zone empty” or “Buffer zone full”.

Dimensioning

Buffer zone sections IB = Identbox, CB = Countbox, SB = Sortbox	**IB**	**CB**	**SB**
Buffer zone section A Section between conveyor belt and sensor Section A must accept all conveyed parts which lie between the camera and the sensor when a conveyed part has been registered by the sensor. The length depends on: – the geometry of the conveyed parts – the maximum transport rate of the small parts conveyor – the length of the conveyor belt	x	x	x
Buffer zone section AB Section between sensors 1 and 2 (only buffer zones with 2 sensors). Section AB determines the switching delay (hysteresis) of the small parts conveyor for regulating the supply of parts. The longer the section is, the less is the switching frequency.	x	x	
Buffer zone section B Section between sensor and following machine. When the small parts conveyor is switched on again, operation of the assembly plant without interruption must be guaranteed before the first new conveyed parts arrive. Section B must be designed so that a sufficient number of conveyed parts are available. The length depends on: – the geometry of the conveyed parts – the maximum time delay beween the small parts conveyor being switched on again and the availability of the new conveyed parts – the length and speed of the conveyor belt	x	x	x



Identbox, Countbox
Identbox and Countbox are operated with a buffer zone. The buffer zone can be monitored by one, or for switching delay (hysteresis) of the small parts conveyor, with two sensors.

Buffer zone with one sensor (Identbox/Countbox)

1 Conveyor belt of the Checkbox

2 Buffer zone

3 Sensor 1

4 Buffer zone section A

5 Section B

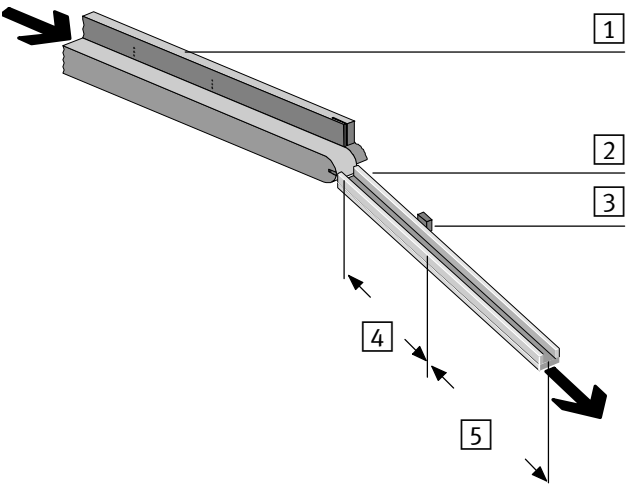


Fig. 1/3: Buffer zone sections (1 sensor)

Signal level 24 V DC active low	**Meaning**	**Result**
LOW at sensor 1	Buffer zone is full	– LCD TOLERANCE switches to FULL – Good parts are blown down – After a preset time, e.g. 30 s, the small parts conveyor will be switched off – The conveyor belt continues to run
HIGH at sensor 1	Sensor does not register any conveyed part	The small parts conveyor is switched on.

Buffer zone with two sensors (Identbox/Countbox)

1 Conveyor belt of the Checkbox

2 Sensor 2

3 Sensor 1

4 Buffer zone

5 Buffer zone section A

6 Section AB

7 Section B

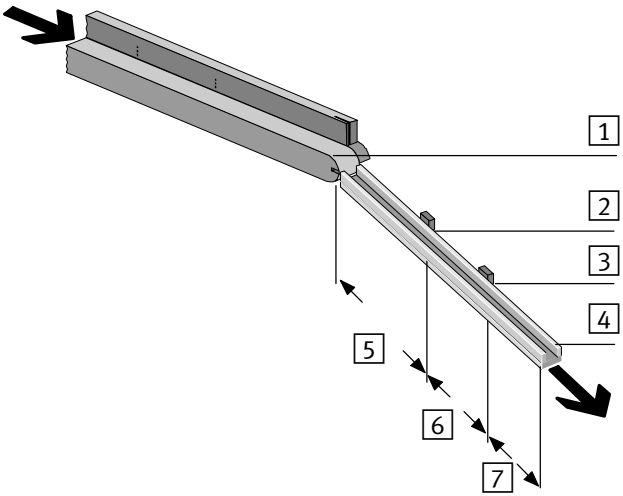
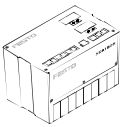


Fig. 1/4: Buffer zone sections (2 sensors)

Signal level 24 V DC active low	**Meaning**	**Result**
LOW at sensor 2	Buffer zone is full	– LCD TOLERANCE switches to FULL – Good parts are blown down – After a preset time, e.g. 30 s, the small parts conveyor will be switched off – The conveyor belt continues to run
HIGH at sensor 1	Sensor does not register any conveyed part	The small parts conveyor is switched on.



Sortbox
The Sortbox is operated with max. 6 buffer zones. Each buffer zone can be monitored by a sensor.

Buffer zones each with one sensor (Sortbox)

1 Conveyor belt of the Checkbox

2 Sensor 1

3 Buffer zone

4 Buffer zone section A

5 Section B

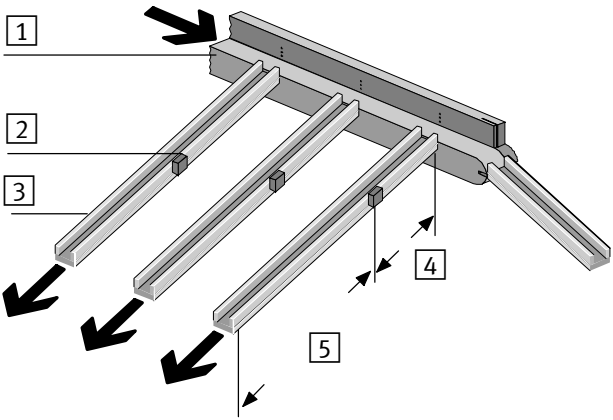


Fig. 1/5: Buffer zone sections (1 sensor per buffer zone)

Signal level 24 V DC active low	**Meaning**	**Result**
LOW at individual sensor outputs	Individual buffer zones are full	– LCD TOLERANCE shows FULL for the relevant parts type. – Following good parts of the parts type are blown down. – Bad or foreign parts are transported to the delivery position.
LOW at all sensor outputs	All buffer zones are full	– LCD TOLERANCE switches to FULL and flashes at 1 second intervals. – After a preset time, e.g. 30 s, the small parts conveyor will be switched off. – The conveyor belt continues to run.
HIGH on at least one sensor output	At least one sensor does not register any conveyed part	The small parts conveyor is switched on.

Fitting and Installation

Chapter 2

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2.1 Fitting the modules

Transport

Always transport the Checkbox in the original packing; further transport safety measures are not required.

Mounting location

Please note
Handle all the modules on the Checkbox with care. Please note especially the following ambient conditions:

- The checkbox must be placed in a location free of vibration.
- The ambient air must be clean: free of oil, no varnish spray, no grinding dust.
- Screening from external light and extreme magnetic fields (e.g. by induction furnaces).

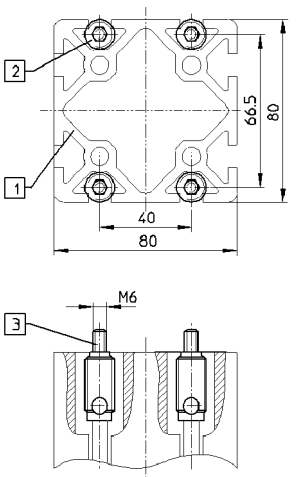
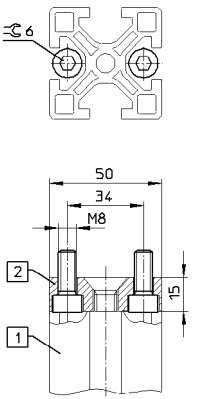
In this way you will achieve optimum test results and guarantee a long service life of the devices.

Space required

Please observe the space required for mounting the Checkbox. The dimensions of the Checkbox and weight specifications can be found in chapter A5.

Fastening the conveyor unit

There are threaded holes on the bottom of the conveyor unit for fastening it with standard profile sections, e.g. ITEM, HERON, ROBOTUNITS.

ITEM profile section 80 x 80 mm	**HERON profile section 50 x 50 mm**
1 Item profile section 80 x 80 mm 2 Item automatic connector 3 4 x slotted head screw M6x40 DIN 912	1 Heron profile section 50 x 50 mm 2 Heron connector HV-50 as connector 3 2 x slotted head screw M8
	

Fastening the controller

Fasten the controller with 4 M8 screws on the rear of the controller housing.

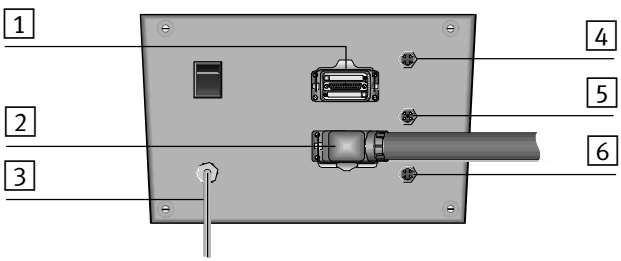
Fitting guides

Integrate the conveyor unit in the material flow in order to ensure a reliable supply of parts from the small parts conveyor onto the conveyor belt. Ensure also the transfer of parts from the conveyor belt to the buffer zone (e.g. drop pipe, slide, shaker) of the next machine by mechanical devies.

You can obtain mounting plates as accessories for fastening mechanical supply or delivery guides to the conveyor unit.

Connecting the controller

There are plug connectors on the side of the controller for periphery devices, control and signal connections. Further information on the individual connections can be found in the chapters which follow.



1 Controller X4

2 Conveyor unit with camera (hybrid cable) X5

3 Mains cable

4 Diagnostic interface X1

5 Small parts conveyor X2

6 Buffer zone sensors X3

Fig. 2/1: Connections and interfaces of the controller

2.2 Power supply connections of the controller

2.2.1 Electrical connection

Warning
Before carrying out installation and maintenance work always switch off the power supply. Connect the devices only when they are switched off.

The power supply for the Checkbox must comply with the following requirements:

– Voltage range: 85 V to 264 V

– Frequency: 50 Hz/60 Hz

The power unit of the Checkbox automatically recognizes the voltage applied. Adjustment by hand is not necessary.

Warning
Connect the Checkbox only when it is in faultless condition. Use only the original connecting cable.

1 Controller X4

2 Conveyor unit with camera X5

3 Mains cable

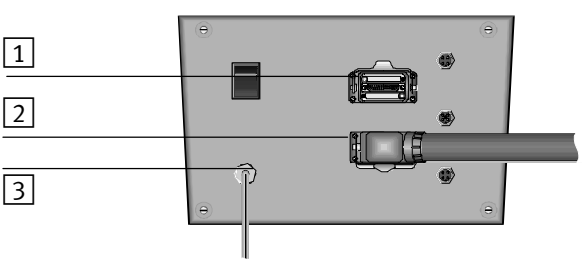


Fig. 2/2: Electrical connections of the controller

Connect the Checkbox modules to the power supply as follows:

- To provide the power supply for the I/O module, insert the plug “Controller” into connection [1] on the connection side of the controller. The plug is set at the factory to “Internal power supply”. Please refer here to the information in chapter 3.2.
- Connect the hybrid cable on the connection side of the controller to connection [2] on the bottom of the conveyor unit.

Please note
Insert the hybrid cable very carefully. Make sure that the plug is fully inserted before you close the locking lever.
This will prevent the contacts from bending.

- Plug in the mains cable for the power supply to the Checkbox.

2.2.2 Pneumatic connection

Please note
Connect the Checkbox only to filtered, non-lubricated and dried compressed air. In this way you will avoid damage to the devices as a result of contaminated compressed air.

The compressed air supply for the rejecct valves must fulfil the following requirements:

– supply: 4...6 bar overpressure
– non-lubricated
– dried and filtered with filter 40 µm.

Please note
There must be an overpressure of 4...6 bar in the operating modes SELECT and AUTO. Only in this way can you be sure that bad or incorrect parts are blown down and are not deposited in the following machine.

1 Compressed air connection

2 Connecting the controller

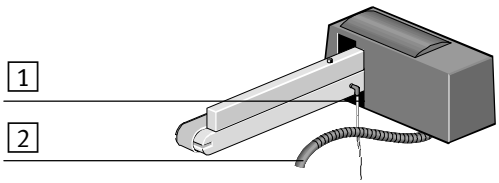


Fig. 2/3: Connections of the conveyor unit

Please note
Use the Checkbox only with the compressed air tubing from Festo included in delivery:
part no. 152 587 (⌀ 8 mm, 3 m long, quick coupling plug).

Connect the Checkbox conveyor unit to the compressed air supply as follows:

- Insert the end of the compressed air tubing intended for the screw connector into the Quickstar plug connector on the conveyor unit.
- Provide the connection to the compressed air supply via the quick coupling plug on the compressed air tubing.
- Use a screwdriver to set the blow-down pressure on the restrictors of the reject valves so that the conveyed parts can be reliably blown down.

2.3 Operation without buffer zone sensors

[1] Controller X4

[2] Sensors X3

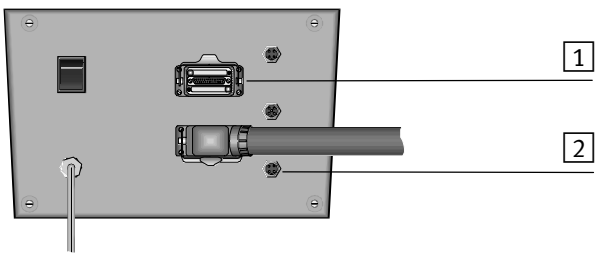


Fig. 2/4: Connecting the plugs “Controller” and “Sensors”

For operation without buffer zone sensors, all sensor inputs of the connections “Controller” and “Sensors” must be set to HIGH. Only in this way is the Checkbox ready to operate. Otherwise the LCD TOLERANCE will show the status FULL in the operating mode AUTO. All good parts will be blown down. The small parts conveyor will be switched off after 30 s (standard setting).

Use the (blanking) plugs wired at the factory to connect the sensor inputs with the 24 V DC reference voltage.

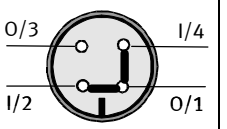
– The 4-pin plug “Sensors” for the buffer zone sensors 1...2.

– The 37-pin Sub-D plug “Controller” alternatively for the buffer zone sensors 1...2 (Identbox, Countbox) or 1...6 (Sortbox).

• Screw the plug “Sensors” into connection [2]. Sensor inputs 1...2 are then wired with the reference voltage.

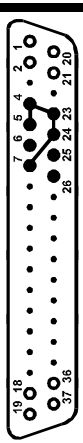
• Make sure that the plug “Controller” is inserted at connection [1] (see 2.2.1 Supplying the I/O module). At the same time, sensor inputs 3...6 of the Sortbox are wired with the reference voltage.

Operation without buffer zone sensors
Connector socket “Sensors” on the Checkbox

O/1	24 V DC reference sensors	
I/2	Buffer zone sensor 2	
O/3	0 V reference sensors	
I/4	Buffer zone sensor 1	

The sensor inputs are negative-switching (normally-closed).
If 24 V DC is applied, the small parts conveyor will be switched on.
The 4-pin plug “Sensors” wired at the factory bridges the sensor inputs I/2 and I/4 with 24 V DC. The inputs I/25 and I/26 at the connection “Controller” are then connected internally with the reference voltage.

Operation without buffer zone sensors
Connector socket “Controller” on the Sortbox

O/7	24 V DC reference voltage	
I/25	Buffer zone sensor 1	
I/6	Buffer zone sensor 2	
I/24	Sortbox Buffer zone sensor 3	
I/5	Sortbox Buffer zone sensor 4	
I/23	Sortbox Buffer zone sensor 5	
I/4	Sortbox Buffer zone sensor 6	

Sensor inputs I/25 and I/26 are already connected internally to 24 V DC via the plug “Sensors”. The plug “Controller” wired at the factory bridges the connections “Buffer zone sensors 3...6”.

2.4 Operation with buffer zone sensors

Use the plugs provided for connecting buffer zone sensors to the Checkbox:

– the 4-pin plug “Sensors” with 1...2 sensors (chapter 2.4.1)

– the 37-pin Sub-D plug “Controller” with more than two sensors (Sortbox, chapter 2.4.2).

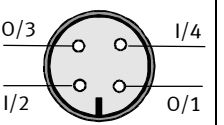
The plug “Controller” is wired at the factory for internal power supply of the I/O module. This configuration is only permitted for operation with buffer zone sensors. If you connect the Checkbox to other devices, e.g. a PLC, via the connection “Controller,” you must connect the I/O module to an external power supply.

2.4.1 Buffer zone sensors at the connection “Sensors”

Use the 4-pin plug “Sensors” provided.

1. Loosen the knurled nut of the plug from the plug housing.
2. Loosen the screw terminals on the plug and remove the bridges fitted at the factory between the sensor inputs and the reference voltage.
3. Connect the buffer zone sensors to the non-assigned sensor inputs.
4. Screw the plug into the plug housing.

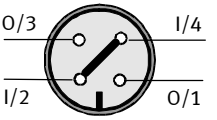
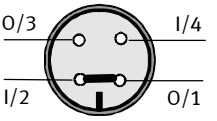
Operation with 2 buffer zone sensors
Connector socket “Sensors” on the Checkbox

O/1	24 V DC Reference voltage	
I/2	Buffer zone sensor 2	
O/3	0 V Reference voltage for sensors	
I/4	Buffer zone sensor 1	

The sensor inputs are negative-switching (normally-closed).
If 24 V DC is applied, the small parts conveyor will be switched on.
As an option, direct connection with a Festo DUO cable is also possible. Cable designation signal x (= I/1), signal x+1 (= I/2).

If only one buffer zone sensor is required, bridge the unused sensor input according to your Checkbox type.

Operation with 1 buffer zone sensor
Connector socket “Sensors” on the Checkbox

	**Identbox, Countbox** Connect both sensor inputs I/4 and I/2 with each other.
	**Sortbox** Connect the unused sensor input, e.g. I/2, with the 24 V DC reference voltage (HIGH).

Please note

- Screw the ready-to-use plug “Sensors” into connection [2] (Fig. 2/4).
- Insert the plug “Controller” wired at the factory into connection [1].

Only in this way is the Checkbox ready to operate.

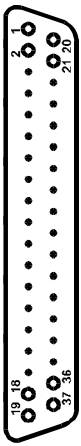
2.4.2 Buffer zone sensors at the connection “Controller”

Use the Sub-D plug “Controller” provided, if you wish to connect more than two buffer zone sensors to the Sortbox.

1. Loosen both screws and locking rings on the Sub-D plug.
2. Remove the bridges fitted at the factory between the sensor inputs and the reference voltage.
3. Connect the buffer zome sensors with the unused sensor inputs (see following table).
4. Connect unused sensor inputs with the 24 V DC reference voltage (HIGH).
5. Place the locking rings on the screws and tighten the plug on the plug housing.
6. Insert the plug into connection [1] (Fig. 2/4).

Operation with 2 buffer zone sensors
Connector socket “Controller” on the Sortbox

O/7	24 V DC reference voltage
O/26	GND 0 v reference voltage
I/25	Buffer zone sensor 1
I/6	Buffer zone sensor 2
I/24	Buffer zone sensor 3
I/5	Buffer zone sensor 4
I/23	Buffer zone sensor 5
I/4	Buffer zone sensor 6



Please note
The inputs “Sensor 1” and “Sensor 2“ are provided both at connection “Sensors” as well as at connection “Controller”.

If you are using both sensor inputs at the connection “Controller”:

- Remove the bridges fitted at the factory in the plug “Sensors”.
- Then screw the plug “Sensors” into connection [2] (Fig. 2/4).

Only in this way is the Checkbox ready to operate.

2.4.3 Controlling the small parts conveyor

If there is no connection on the small parts conveyor for an external switching contact, you can use the power circuit module available as an accessory for controlling the small parts conveyor.

[1] Conveyor unit X2

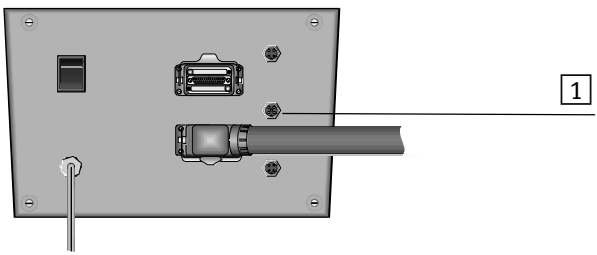
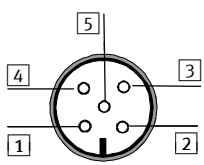


Fig. 2/5: Connection “Small parts conveyor” on the Checkbox

If an external switching contact can be connected to the small parts conveyor, connect it according to the following pin assignment:

Connector plug “Small parts conveyor” on the Checkbox		
[1]	Normally-open contact 1	
[2]	Normally-open contact 2	
[3] [4] [5]	Not assigned	
Contact loading 48 V / 100 mA		

On the connection “Controller” there is also an output (O/37) intended for controlling the small parts conveyor. However, this is not designed as a floating normally-open contact, but as a 24 V power output.

2.5 Diagnostic interface

In order to connect the Checkbox to the PC, use the serial diagnostic cable with 4-pin round plug (connection Checkbox) and 9-pin Sub-D plug (connection PC).

[1] Diagnostic interface X1

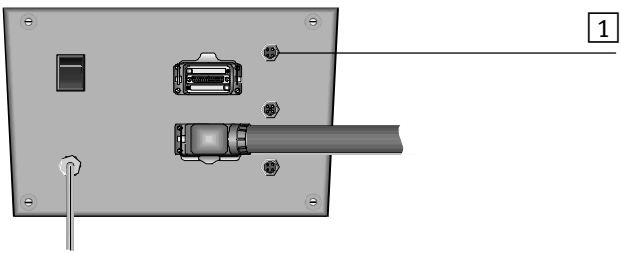


Fig. 2/6: Diagnostic connection of the controller

The diagnostic cable is included in delivery with the Checkbox or with the CheckKon software. If required, the diagnostic cable is also available as an accessory, see Appendix A.6.

- Connect the diagnostic cable to the following connections:
  - the diagnostic interface (X1) on the Checkbox,
  - a serial interface COM1 or COM2 of the PC.
- Remove the diagnostic cable as soon as you have finished working with CheckKon/CheckOpti. In this way you will avoid malfunctioning of the Checkbox.

If, in exceptional cases, the connection between the PC and the Checkbox is necessary for continuous operation:

- Use an electrical isolation (optocoupler) between the PC and the Checkbox. If you have any technical problems, please consult your Festo Service.

Further information on commissioning, optimizing and monitoring the Checkbox via the PC interface can be found in the documentation for the software packages CheckOpti and CheckKon.

The I/O module on the Checkbox

Chapter 3

Contents

3.	**The I/O module on the Checkbox**	**3-1**
3.1	I/O functions	3-3
3.2	Internal power supply of the I/O module	3-5
3.3	Connecting a higher-order controller	3-8
3.4	Start/stop mode	3-10
3.5	Counter reading check (Countbox, Sortbox)	3-13
3.6	Displays at the transfer position	3-14
3.7	Selecting the parts type/sorting program	3-17
3.8	Error message	3-21

3.1 I/O functions

[1] Controller X4

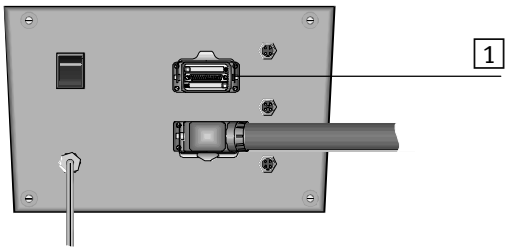
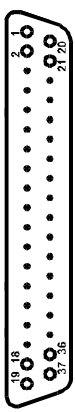


Fig. 3/1: Connector socket “Controller” on the Checkbox

The connection “Controller” contains the I/O module of the Checkbox with the following switching and connecting possibilities:

Connector socket “Controller”			
Pin	**Connection**	**Function**	
I/4...I/6 I/23...I/25	Buffer zone sensors	Depending on Checkbox design – 2 to 6 sensor inputs. The configuration of these inputs is described in chapters 2.3 “Operation without buffer zone sensors” and 2.4 “Operation with buffer zone sensors”.	
O/37	Conveyor unit	A 24 V power output is provided at pin 37 for controlling the small parts conveyor (see also chapter 2.4.2 “Controlling the small parts conveyor”).	
O/1...O/3 O/9...O/12 O/15, O/20 O/28...O/31 O/21, O/22 I/32, I/33	Controller	For communication of the Checkbox e.g. with a programamble logic controller or a subsequent machine: See further information in chapter 3.3 “Connecting a higher-order controller”.	
26, 7	Reference voltage	GND, + 24 V DC	
15, 16 34, 35	Power supply	Internal or external power supply for the I/O module is described in section 3.2 “Power supply for the I/O module”.	

Electrical characteristics

Electrical characteristics of the I/O signals	
Outputs	– Max. current loading per channel: 250 mA – Max. sum current of all outputs: 1.5 A – PNP-switching
Inputs	– Input current: 5 mA (constant) – Logical “1”: V_{ON} > 15 V – Logical “0”: V_{ON} < 7 V – PNP-switching

Please note
If you use high resistance measuring devices for measuring the voltage at the outputs, a minimum loading of 1 mA will be required.
In this way you can be sure that correct voltage values will be displayed.

3.2 Internal power supply of the I/O module

The I/O module of the Checkbox is connected via pin I/15 (24 V DC) and pin I/34 (GND) to the built-in power unit or external power source. Use the Sub-D plug “Controller” provided for connecting the power supply.

Important note
In the case of internal supply of the I/O module, devices connected to the Checkbox have direct electrical coupling with the power supply for the Checkbox processor.

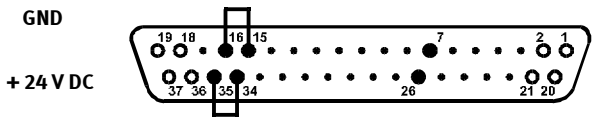
The circuit type “Internal supply” is therefore only permitted for connecting buffer zone sensors. The circuit type “External supply” is stipulated for other applications.

Internal supply

The plug “Controller” is wired at the factory for internal power supply for operation with buffer zone sensors. The I/O module is operated thus via the power unit for the Checkbox.

Connector socket “Controller” on the Checkbox
Internal power supply

O/16	Internal GND
O/35	Internal + 24 V DC
I/15	External GND
I/34	External + 24 V DC



External supply

External supply of the I/O module is stipulated to ensure EMC conformity. The external supply must be electrically isolated from the internal power supply to the Checkbox.

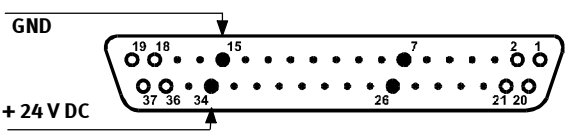
The external power supply also supplies the valves at the blow-down positions on the conveyor unit. The power unit must therefore be designed for loading currents of 1...3 A.

Important note
Connect the I/O module of he Checkbox to an external power supply if you are using the Checkbox in conjunction with other devices. To do this, modify the factory setting of the Sub-D plug “Controller” provided.

In this way you will avoid malfunctioning and damage to the device.

Connector socket “Controller” on the Checkbox
External power supply

I/15	External GND
I/34	External + 24 V DC



Use the Sub-D plug “Controller”.

1. Loosen both screws and locking rings on the plug housing.
2. Remove the bridge between pins 16 and 15 (GND).
3. Remove the bridge between pins 35 and 34 (+ 24 V DC).
4. Connect pin 15 with the earth/ground potential (0 V) of the external power supply.

5. Connect pin 34 with the + 24 V potential of the external power supply.
6. Place the locking rings on the screws and tighten the plug on the plug housing.
7. Insert the configured plug into the connection “Controller”.

Reference voltages

The voltage applied to pins I/15 and I/34 is available as reference voltage at pins O/7 and O/26. In the stop status this reference voltage is switched off.

Pin	Title	Function
O/26	Reference voltage GND	e.g. as reference potential for PLC
O/7	Reference voltage + 24 V DC	e.g. as power supply for buffer zone sensors
Fuses 300 mA, self-resetting		

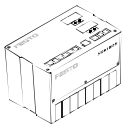
3.3 Connecting a higher-order controller

Important note
If you connect the Checkbox to other devices, e.g. a PLC, via the connection “Controller”, you must connect the I/O module to an external power supply (see chapter 3.2).

You can then guarantee faultless operation and prevent serious damage to the Checkbox electronics.

For remote control of the Checkbox, connect the following control and signal lines of the I/O module:

Pin	Title	Function
I/33 O/2 O/14	Remote start Operating mode 0 Operating mode 1	Start/stop mode (remote)
O/31 O/12 O/30 O/11 O/29 O/20 O/1	Actuator 1 Actuator 2 Actuator 3 Actuator 4 Actuator 5 Actuator 6 Actuator 7	Displays at the transfer position: – Good parts – Incorrectly orientated parts/incorrect parts type – Bad/foreign parts
O/3 O/22 O/21	Fault status 0: Warning Fault status 1: Error Fault status 2: Classification	Error messages



The following functions are type-specific:

Pin	Title	Function
Identbox		
I/10 I/28 I/9 I/27 I/8	Parts type bit 0 Parts type bit 1 Parts type bit 2 Parts type bit 3 Parts type bit 4	External type selection
Countbox		
I/32 O/13	Start new counting cycle Preselected counter reading reached	Counter reading check
I/10 I/28 I/9 I/27 I/8	Parts type bit 0 Parts type bit 1 Parts type bit 2 Parts type bit 3 Parts type bit 4	External type selection
Sortbox		
I/32 O/13	Start new counting cycle Preselected counter reading of all parts types reached	Counter reading check
I/10 I/28 I/9 I/27	Sorting program bit 0 Sorting program bit 1 Sorting program bit 2 Sorting program bit 3	External sorting program selection

3.4 Start/stop mode

Remote-controlled starting presupposes that the Checkbox has been switched on with the mains switch.

The Checkbox is started with a change of signal at pin I/33 LOW›HIGH and stopped again by a change of signal HIGH›LOW.

Pin	Signal level	Meaning
I/33	LOW›HIGH	Starts the Checkbox
	HIGH›LOW	Stops the Checkbox
	1. Apply LOW for ½ second 2. Apply HIGH permanently	Deleting the error

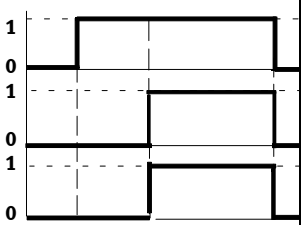
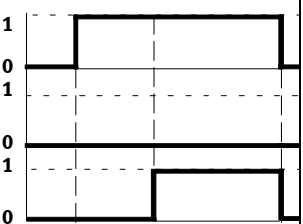
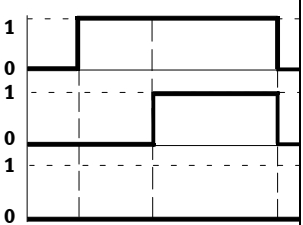
The following applies with alternating control either by manual operation or via the I/O module:

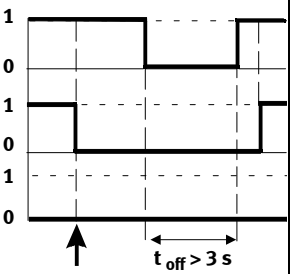
– After a manual start:
  If the Checkbox is switched on with the START button, it can still be switched off with the change of signal HIGH›LOW (stop signal) at pin I/33.

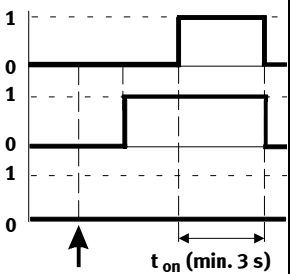
– After a start signal from the controller:
  If there is a constant HIGH signal at pin I/33, the Checkbox can still be switched off with the STOP button.

– After a manual stop:
  With a change of signal LOW›HIGH (start signal) at I/33, the Checkbox can be switched on again after a manual stop.

The modification to the operating status with a manual start or stop is passed on to the controller via O/14 and O/2. The output signals differ according to operating mode and status, as represented in the pulse-time diagrams.

Operating mode	**Pulse-time diagram** Operating status after a manual stop:
AUTO	
TEACH	
SELECT	

Operating mode	**Pulse-time diagram** Operating status Switching on again after a manual stop:
SELECT	Pin I/33 Remote start Pin O/14 Checkbox mode 1 Pin O/2 Checkbox mode 0  Manual stop

Operating mode	**Pulse-time diagram** Operating status External stop signal from the controller after a manual start
SELECT	Pin I/33 Remote start Pin O/14 Checkbox mode 1 Pin O/2 Checkbox mode 0  Manual start

3.5 Counter reading check (Countbox, Sortbox)

Good parts counting with preselected number of items

When the last good part of a counting process reaches the reject position for bad or foreign parts, output O/13 will be switched from LOW›HIGH (nominal number reached) via the connection “Controller”.

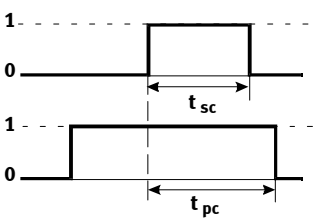
In order to start the counting cycle again, you must switch output I/32 from LOW›HIGH. The Checkbox then resets output O/13 from HIGH›LOW and begins the new counting cycle.

Pin	Signal level	Meaning
I/32	HIGH	Starts the new counting cycle
O/13	HIGH	Preselected counter reading (of all parts types) reached
O/13	LOW	Preselected counter status not yet reached.

Pulse-time diagram
Counter reading check

Pin I/32
Start new counting cycle
100 ms < t_{sc} < 500 ms

Pin O/13
Preselected counter reading reached
t_{pc} = max. 600 ms



sc = start counting cycle pc = preselected counter status

3.6 Displays at the transfer position

The number and arrangement of the delivery positions can vary depending on the Checkbox version. The following diagram refers to the standard configuration set at the factory.

Standard transfer positions of the Identbox/Countbox on a conveyor unit with 2 reject positions

The compressed air valves of the reject positions are connected directly to the outputs actuators 1...2. These outputs are set at + 24 V DC if the parts test delivers the following result:

– incorrectly orientated or superfluous (good) part

– bad or foreign part.

If the Checkbox recognizes a test part as a good part, pin O/30 (actuator 3) will be set from rest potential 0 V to + 24 V DC.

Signal level: Actuators 1...3 Connection "Controller" of the Identbox/Countbox		**Pin**
Actuator 1	The + 24 V DC signal is present when the test part passes the reject nozzle for incorrectly orientated or superfluous good parts. The duration of the signal corresponds to the time the part requires to pass the nozzle.	O/31
Actuator 2	The + 24 V DC signal is present when the test part passes the reject nozzle for bad or foreign parts. The duration of the signal corresponds to the time the part requires to pass the nozzle.	O/12
Actuator 3	The + 24 V DC signal is present when the good part passes the end of the system edge (guide rail of the conveyor unit).	O/30

The outputs O/1, O/11, O/20, O/29 are intended as an option for further actuators. If the appropriate periphery is present, four further reject positions can be installed via these outputs.

Note the following when evaluating the output sugnals “Actuators...” by means of a higher-order controller: If the test parts are passed through at a high rate, some parts may be blown back although previously tested parts have not yet been blown down. This delay arises due to the long distance between the return valve and the reject valve.

Standard transfer positions of the Identbox/Countbox on a conveyor unit with 6 reject positions

The compressed air valves of the reject positions are connected directly to the outputs actuators 1.6. These outputs are set at + 24 V DC if the parts test delivers the following result:

– incorrectly orientated or superfluous (good) part

– good part of a certain parts type.

If the Checkbox recognizes a test part as a bad or foreign part, pin O/1 (actuator 7) will be set from rest potential 0 V to + 24 V DC.

Signal level: Actuators 1...7 Connection “Controller” of the Sortbox		**Pin**
Actuator 1	The + 24 V DC signal is present when the test part passes the reject nozzle for incorrectly orientated or superfluous good parts. The duration of the signal corresponds to the time the part requires to pass the nozzle.	O/31
Actuators 2...6	The +24 V DC signals are present when test parts pass the reject nozzle for good parts of a certain parts type. The duration of the signal corresponds to the time the part requires to pass the nozzle.	O/12 O/30 O/11 O/29 O/20
Actuator 7	The + 24 V DC signal is present when the bad or foreign part passes the end of the system edge (guide rail of the conveyor unit).	O/1

3.7 Selecting the parts type/sorting program

A higher-order controller can automatically change the parts type of the Identbox/Countbox or the sorting program of the Sortbox:

– Pin I/33 › LOW:
  The Checkbox switches to the stop status.

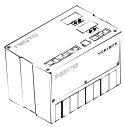
– The signals at the inputs are then set according to the binary coding of the desired parts type or sorting program (see following tables). The signals must be present permanently.

– Pin I/33 › HIGH:
  The Checkbox switches to the start status.

The selection possibility is limited to maximum 30 parts types or 14 sorting programs.
The selection depends on the operating system of the Checkbox. For this reason, not all binary codings specified lead to the selection of a valid parts type/sorting program.

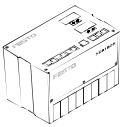
Identbox, Countbox
Binary coding of the parts type

Parts type	**I/10** 2^0	**I/28** 2^1	**I/9** 2^2	**I/27** 2^3	**I/8** 2^4
No preselection	LOW	LOW	LOW	LOW	LOW
1	**HIGH**	LOW	LOW	LOW	LOW
2	LOW	**HIGH**	LOW	LOW	LOW
3	**HIGH**	**HIGH**	LOW	LOW	LOW
4	LOW	LOW	**HIGH**	LOW	LOW
5	**HIGH**	LOW	**HIGH**	LOW	LOW
6	LOW	**HIGH**	**HIGH**	LOW	LOW
7	**HIGH**	**HIGH**	**HIGH**	LOW	LOW
8	LOW	LOW	LOW	**HIGH**	LOW
9	**HIGH**	LOW	LOW	**HIGH**	LOW
10	LOW	**HIGH**	LOW	**HIGH**	LOW
11	**HIGH**	**HIGH**	LOW	**HIGH**	LOW
12	LOW	LOW	**HIGH**	**HIGH**	LOW
13	**HIGH**	LOW	**HIGH**	**HIGH**	LOW
14	LOW	**HIGH**	**HIGH**	**HIGH**	LOW
15	**HIGH**	**HIGH**	**HIGH**	**HIGH**	LOW
16	LOW	LOW	LOW	LOW	**HIGH**
...	...	...	...	...	...
30	LOW	LOW	LOW	LOW	**HIGH**
No preselection	**HIGH**	**HIGH**	**HIGH**	**HIGH**	**HIGH**



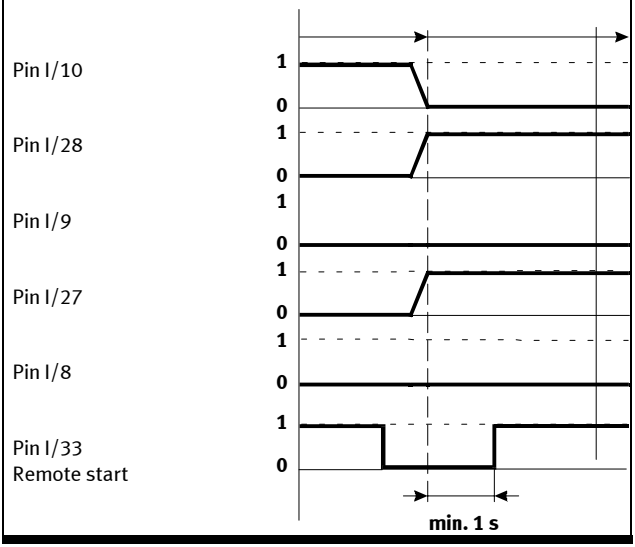
Sortbox
Binary coding of the sorting program

Sorting program	**I/10** 2^0	**I/28** 2^1	**I/9** 2^2	**I/27** 2^3
No preselection	LOW	LOW	LOW	LOW
1	**HIGH**	LOW	LOW	LOW
2	LOW	**HIGH**	LOW	LOW
3	**HIGH**	**HIGH**	LOW	LOW
4	LOW	LOW	**HIGH**	LOW
5	**HIGH**	LOW	**HIGH**	LOW
6	LOW	**HIGH**	**HIGH**	LOW
7	**HIGH**	**HIGH**	**HIGH**	LOW
8	LOW	LOW	LOW	**HIGH**
9	**HIGH**	LOW	LOW	**HIGH**
10	LOW	**HIGH**	LOW	**HIGH**
11	**HIGH**	**HIGH**	LOW	**HIGH**
12	LOW	LOW	**HIGH**	**HIGH**
13	**HIGH**	LOW	**HIGH**	**HIGH**
14	LOW	**HIGH**	**HIGH**	**HIGH**
No preselection	**HIGH**	**HIGH**	**HIGH**	**HIGH**



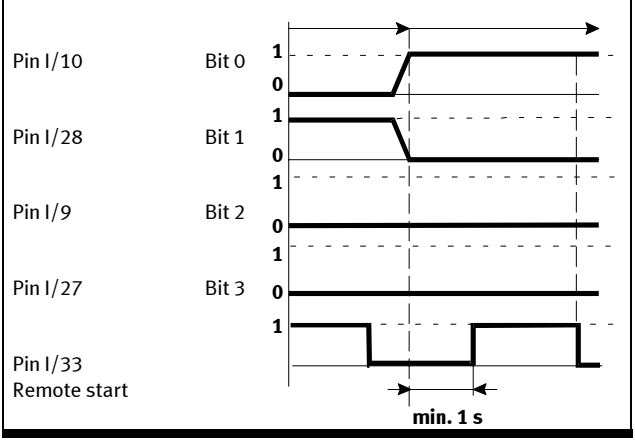
Identbox, Countbox

Pulse-time diagram Parts type change 1 › 10



Sortbox

Pulse-time diagram Sorting program change 2 › 1



3.8 Error message

The Checkbox signals faults at the connection “Controller” as:

– Warning at pin O/22

– Fault at pin O/3

The output signals are evaluated e.g. with a machine light with the following displays:

Green: faultless operation
Yellow: Warning
Red: Fault

Signal level: Error message	**O/22**	**O/3**
There is a fault	HIGH	LOW
There is a warning	LOW	HIGH

The classification of the warning or of the fault is made via pin O/21 as shown in the two following tables:

Error

Errors indicate a functional fault in the Checkbox. The Checkbox stops and the operator must intervene.

Code E...	**Signal level: Error**	**O/22**	**O/3**	**O/21**
< 60	Ambient error Recognition error or memory error	HIGH	LOW	**LOW**
> = 60	Hardwar error	HIGH	LOW	**HIGH**

As standard, all error messages which stop the Checkbox are defined as errors.

By means of a factory configuration or subsequent conversion with the aid of the CheckKon configurator software, error E 05 can be redefined as a warning.

Warnings

Warnings indicate a status of the Checkbox which requires the intervention of the operator.

Signal level: Warning	**O/22**	**O/3**	**O/21**
Material jam or small parts conveyor is empty (E 05).	LOW	HIGH	**HIGH**

Commissioning

Chapter 4

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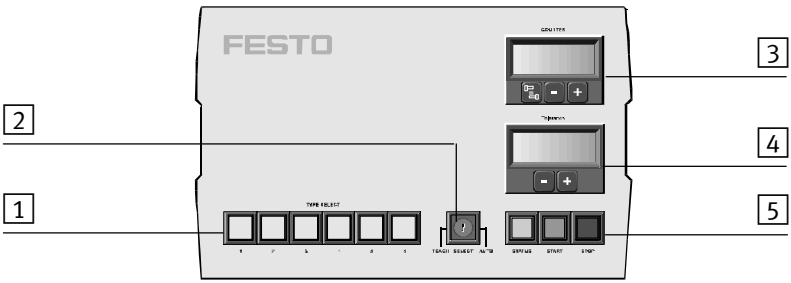
4.1 Control panel of the Checkbox



Operating elements		Functions	
1	Illuminated buttons for selecting/displaying the parts type	TYPE SELECT [1]...[6]	
2	Keyswitch for selecting the operating modes	– TEACH – SELECT – AUTO	Learning new parts Test /adapt parameters Automatic mode
3	**Countbox/Sortbox:** Display for selecting the counter type and for setting the counter	– LCD COUNTER – Illuminated buttons – Push buttons [-][+]	Display of current counter status or nominal number Acceptance of the good parts OFF: in nominal orientation ON: in all orientations Select counter function, preselect nominal number, reset counter
4	Display for showing and setting the test parameters	– LCD TOLERANCE – Push buttons [-][+]	Display of configuration, Error messages Test results ... Setting the memory group Orientation, tolerance
5	Illuminated buttons for monitoring and controlling the operating status	– STATUS (yellow) – START (green) – STOP (red)	Status display / error quitting Switching on Switching off

Fig. 4/1: Control panel of the Checkbox

4.2 Switching on and off

Before switching on the Checkbox you must carry out the following steps as described in chapters 2 and 3:

1. Fitting the modules
2. Connecting the compressed air supply
3. Connecting the power supply
4. Configuration of the connectings “Sensors” and “Controller”: Insert (blanking) plugs or connect the control cables for buffer zone sensors.

1 Mains switch

2 LCD TOLERANCE

3 START button

4 STOP button

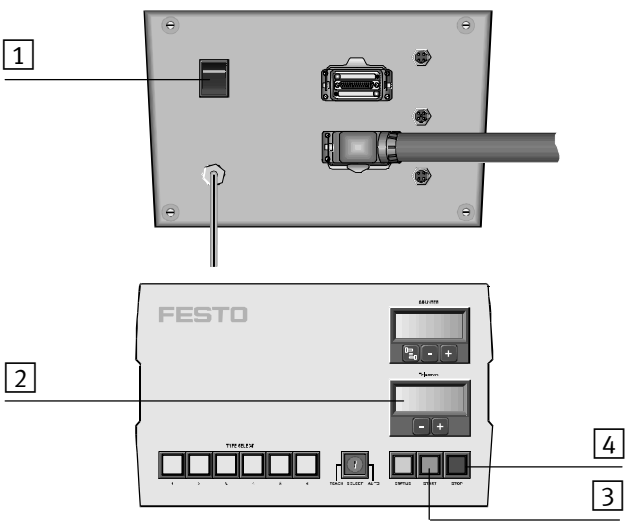


Fig. 4/2: Operating panel

Switching on

Switch on the Checkbox as follows:

1. Actuate the mains switch on the connection side of the controller.
2. When you have switched on, all the displays and illuminated buttons of the Checkbox will light up briefly and indicate readiness to operate. The LCD TOLERANCE will then show the following system information, one item after the other:

LCD	Meaning
I 3.0	Letter for Checkbox design I(dent), C(ount) or S(ort) and version status of the operating system. Example: Identbox version 3.0
6 E	Number of memory groups or sorting programs (Sortbox) and also letter E with system setting “with encoder”. Example: 6 memory locations, encoder
1024	System setting of the camera resolution. Example: 1024 pixels

3. Start the Checkbox with the green illuminated button START. The conveyor belt runs. The START button is lit continuously.

Switching off

Switch off the Checkbox as follows:

1. Press the STOP button. The STOP button is lit continuously. The conveyor belt remains at a stand.
2. Switch off the mains switch on the connection side of the controller.

4.3 Operating modes of the Checkbox

For teaching and checking the conveyed parts you can select one of three operating modes in the Checkbox: TEACH, SELECT and AUTO. You can switch the operating mode with the key switch on the control panel (Fig. 4.1).

TEACH mode

In the TEACH mode the Checkbox learns all features for the parts check with the aid of sample parts. The following steps are required here:

1. Addressing teach data
2. Scanning sample parts
3. Saving teach data

SELECT mode

You can set the SELECT mode in order to

- save the teach data
- check the test procedure
- set the test parameters.

When you switch from TEACH mode to SELECT mode, all the current teach data will be saved automatically. The following parameters will be set in the SELECT mode:

SELECT mode IB = Identbox, CB = Countbox, SB = Sortbox	**IB**	**CB**	**SB**
Selecting the parts type/sorting program	x	x	x
Optimizing the tolerance	x	x	x
Accept good part only in nominal orientation or in all orientations		x	x
Selecting and setting the counter function		x	x

AUTO mode

In the AUTO mode the test procedure runs automatically and can only be influenced manually by means of the START/ STOP buttons.

4.4 Error diagnosis

A diagnostic system is incorporated in the controller of the Checkbox. If an operating fault is recognized, the LCD display TOLERANCE will show an error code and the illuminated buttons TYPE SELECT, STATUS, STOP will flash. As standard all defined error messages are declared as an error, in reaction to which the Checkbox stops.

The Checkbox can be set as the customer desires; depending therefore on the design of the Checkbox or software configuration:

– the error E 05 can be redefined as a warning

– the error messages E 01, E 02, E 04, E 05, E 06 can be deactivated.

The following error groups are defined:

Code	Group	Explanation
E 01...12	Ambient error	Fault in the compressed air supply, the power supply, the parts supply; dirty lens etc.
E 20...21	Recognition errors	Orierntations or sample parts cannot be distinguished
E 40...43	Loss of data	Teach data, configuration data or system parameters are not compatible or do not exist
>=E 60	hardware error	Internal error (can only be rectified by after-sales service)

A detailed list of the codes and instructions on eliminating faults can be found in Appendix A.1.

After eliminating faults:

- Quit the error message with the STATUS button.
- Press the STOP button, then the START button.

Teaching parts with the Checkbox

Chapter 5

Contents

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5.2.3 Saving teach data 5-11

5.1 Preparing the teach procedure

If you are using the CheckKon/CheckOpti software packages, please note the instructions in the software manuals on how to prepare the teach procedure.

As standard during the teach procedure, the parts are blown down from the belt at the first blow-down position. This is to ensure that no sample parts are unintentionaly transported further to the next machine.

5.1.1 Features and characteristics of the conveyed parts

The Checkbox registers conveyed parts as two-dimensional, black-white profile pictures (parts contour). Features for distinguishing different good parts are derived from the parts contour. Discolouring and surface faults do not influence the test result during this recognition process.

The features of the conveyed part, which determine orientation and quality and which are important for the distinguishing process, must be recognizable to the Checkbox.

Provide suitable sample parts for every parts type in accordance with the following specifications:

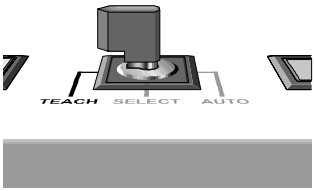
– The sample parts show all the characteristics which a part classified as “good” should possess.
  Use different sample parts with a usual scatter of features. With the scatter of features, you can determine the extent to which test parts later classified as “good” may deviate from each other.

- Small rotationally symmetric parts are particularly suitable. Non-rotationally symmetric parts can however also be checked if a pre-orientation of the conveyed parts is made with the small parts conveyor.
- The conveyed part must be supplied correctly on the conveyor belt.
  - The length, diameter and height of a conveyed part must be suited to the conveyor unit type, see chapter 1.4.
  - The conveyed part must be supplied in a stable orientation (it must not roll away or vibrate).
- The conveyed part must be blown down reliably by the reject nozzles.
  Exceptionally large conveyed parts made of heavy material (e.g. steel) with streamlined shape may, under certain circumstances, not be blown down. Carry out a test to make sure that the conveyed parts are blown down.

5.1.2 Set operating mode TEACH

Prepare the Checkbox as follows:

1. Mount the Checkbox ready for operation.
2. Switch the Checkbox on (mains switch on the rear of the controller).
3. Set operating mode TEACH with the key switch.
4. Press the green START button.



The LCD TOLERANCE shows the current setting of the memory group. The START button lights up; the coveyor belt remains at a stand.

5.2 The teach procedure

Carry out the teach procedure as follows:

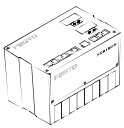
1. Addressing teach data.
2. Scanning sample parts.
3. Saving teach data.

A description of the individual steps can be found in the following sections.

5.2.1 Addressing teach data

During the teach procedure, the data of each parts type are saved in memory groups by means of memory addresses. Maximum 6 different parts types can be addressed in a memory group. Maximum 8 orientations can be assigned to each parts type.

A total of 48 parts types can be addressed depending on the number and assignment of the memory groups. The number of memory groups and the number of orientations per parts type is configured at the factory. (number of memory groups x number of parts types x number of orientationss per parts type = maximum 96).



Sortbox
With the Sortbox, the sorting program is specified by the assignment of a memory group. The number of sorting programs corresponds therefore to the number of memory groups of the Checkbox.

The display TOLERANCE shows memory group 1 when the TEACH mode is switched on. Address the teach data as follows:

1. Set the memory group.
   Set the desired memory group with the keys [+] and [-] on the TOLERANCE display.

2. Determine the parts type.
   Select with one of the TYPE SELECT keys [1]...[6] the number which is to be assigned to the parts type.

When the parts type has been addressed, the Checkbox starts the conveyor belt automatically and you can start scanning the sample parts.

If, when the parts type is selected in the LCD TOLERANCE, the information “tool” is shown, the memory address is assigned with additional software tools. The teach procedure can nevertheless be carried out. Further information can be found in the CheckOpti manual.

5.2.2 Scanning sample parts

The conveyor belt runs during the complete scanning procedure. If you press the STOP button, the teach procedure will be discontinued. The currently registered data will be ignored and the complete teach procedure must be repeated.

Positioning sample parts

The TOLERANCE display shows orientation 1 (nominal orientation). Make sure that the sample parts are positioned in accordance with the orientation shown.

- Show at least six parts of the current type per orientation. If possible use different parts, but if necessary the same part can be shown several times.
- Carry out the teach procedure as realistically as possible. Use e.g. the conveyor unit and supply device intended for this purpose.
- Place the sample parts on the conveyor belt one after the other. They should be positioned exactly like the parts to be tested later. Avoid particular care at first in placing the parts.
- In cases where particularly different variations of the ascertained parts contour (view) are permitted or are possible in an orientation, you should show the “extreme” variations, or as large a number of different variations as possible during the teach procedure.

Observing the scatter of characteristics

The following factors influence the scatter of characteristics:

– Parts geometry

– Different contours of the part, depending on the angle of rotation around the longitudinal axis (e.g. with springs, screws).

– Different positioning on the belt.

A detailed description of the computational algorithm of the scatter of characteristics can be found in Appendix A.3.2.

C . . .

Please observe the TOLERANCE display when scanning the sample parts. This display shows briefly for each part the maximum value of the scatter of chateristics for the feature which curently deviates the most (C- value).

C-value	Meaning
< 10	Sample parts are very similar in all features.
> 30	Large scatter of at least one feature.

– Low values indicate narrrow manufacturing tolerances and a uniform supply of parts.

– Very high values indicate that the taught sample parts differ greatly in their characteristics from each other. If the (good) parts are allowed to differ greatly from each other, the teach procedure can be continued.

It is optimum if the curve of the values changes greatly at first and then remains increasingly constant. If the value only changes slightly, a sufficient scattter is then usually achieved in the current orientation.

If the C-value shown changes considerably, this indicates that the conveyed part has been positioned incorrectly.

1. Press the STOP button to interrupt the teach procedure.

2. Repeat the complete teach procedure for the parts type.

Scanning further orientations

A parts type is not registered completely until the camera has recorded all the intended orientations.

1. Set the next orientation with the butttons TOLERANCE [+] and [-].
2. Scanning the sample parts in the new orientation In order to do this, repeat the steps described in section 5.2.2.

For the test to be reliable, the features ascertained from the individual orientations must be clearly distinguishable from each other.

- Check whether there is at least one feature in which the various orientations differ.
- Make sure in particular that orientation 1 (nominal orientation) differs clearly in at least one feature from all the other orientations.

5.2.3 Saving teach data

Save the teach data when the sample parts of a parts type have been learnt in all intended orientations. Use the key switch to switch to the operating mode SELECT. The teach data will then be saved automatically.

The LCD TOLERANCE then shows in faultless operation the current memory group and the tolerance in per cent, e.g. memory group 1, tolerance 5 %. The current parts type remains selected. The conveyor belt continues to run.

Note the following error displays on the LCD TOLERANCE:

Code	Explanation
	The nominal orientation cannot be distinguished from other orientations. Possible causes The nominal orientation was taught several times by mistake. • Repeat the teach procedure. Make sure that the sample parts are positioned in accordance with the orientation shown. The nominal orientation is too similar to other orientations. • Optimize the teach data with the CheckOpti software. With CheckOpti even minimum differences can be recognized. Please consult your technical advisor in this respect. **Countbox, Sortbox:** If it is not necessary to distinguish the nominal orientation: 1. Turn the key switch to TEACH. 2. Switch on the illuminated button on the LCD COUNTER. 3. Repeat the teach procedure.

Sortbox

Code	Explanation
E 21	The taught sample part cannot be distinguished clearly from other sample parts because e.g. – the sample part is identical to the parts type of another TYPE SELECT memory location; – a different orientation of the sample part has been saved on another TYPE SELECT memory location. • Repeat the complete teach procedure • Optimize the sorting procedure with the CheckOpti software. Please consult your technical advisor in this respect.

After saving you can carry out one of the following steps:

- Keep a record of your work.
- Register the next parts type in a further teach procedure. In order to do this repeat all the steps as from section 5.1.1.
- Check the completed teach procedure in test mode, and pay attention to orientation and quality as described in chapter 6.

Testing parts with the Checkbox

Chapter 6

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6.1 Preparing the test procedure

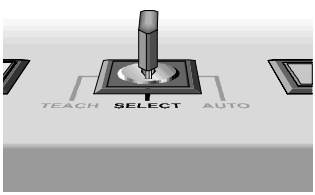
In order to prepare the test procedure, switch the Checkbox to the SELECT mode and set the operating parameters for the test mode or automatic mode.

Operating parameters for the test procedure IB = Identbox, CB = Countbox, SB = Sortbox	**IB**	**CB**	**SB**
Load the teach data	**x**	**x**	**x**
Set the tolerance	**x**	**x**	**x**
Enable the orientations		**x**	**x**
Select and set the counting function (for automatic mode)		**x**	**x**

6.1.1 Set operating mode SELECT

All settings in the SELECT operating mode are made while the conveyor belt is running. Prepare the Checkbox as follows:

1. Carry out teach procedure (see chapter 5).
2. Set key switch to SELECT.



3. If the STOP button is pressed down, press the START button.

1 5

The LCD TOLERANCE then shows the current memory group and the tolerance in per cent, e.g. memory group 1, tolerance 5 %. The current parts type remains selected.

6.1.2 Load the teach data

L 1

Select the memory group of the saved teach data as reference for the test procedure.

1. Press the buttons TOLERANCE [+] and [-] at the same time. The LCD TOLERANCE shows the current memory group.
2. Select the desired memory group.
   - Increase value by 1: Press TOLERANCE [+] briefly.
   - Reduce value by 1: Press TOLERANCE [-] briefly.

The illuminous button TYPE SELECT is switched off. The conveyor belt remains at a stand.

Sortbox
When the memory group is selected, the relevant sorting program is activated.

1. Quit the selection of the sorting program by pressing any illuminous TYPE SELECT [...] button. The conveyor belt starts again. The LCD TOLERANCE shows the selected memory group and the tolerance in per cent.
2. Set further parameters or start with the test mode (chapter 6.2).

Identbox, Countbox
The current parts type selection is deleted when the memory group is changed.

1. Select the new parts type with the illuminous button TYPE SELECT [...]. The conveyor belt starts again. The LCD TOLERANCE shows the selected memory group and the tolerance in per cent.

2. Set further parameters or start with the test mode (chapter 6.2).

6.1.3 Set the tolerance

The tolerance increases the band width of the taught features. Test parts, the features of which lie within the band width of the sample part or in the tolerance range bordering onto this, will still be accepted as good parts.

The setting range of the tolerance lies between 0 and 20 %. If the tolerance = 0, only those parts, the features of which lie within the band width of the sample parts scanned during the teach procedure, will be accepted as good parts. The tolerance is preset at the factory with 5 % (standard setting).

Set at least 1 % tolerance. You can then be sure that good parts are correctly classified despite minimum position deviations.

The LCD TOLERANCE shows the current memory group and the tolerance in per cent. Set the tolerance as follows:

1. With the TOLERANCE [+] button, you can increase the value displayed by 1.
2. With the TOLERANCE [-] button, you can reduce the value displayed by 1.

The value selected will automatically be added to the data of the parts type and saved.

With critical conveyed parts, you must ascertain the optimum setting of the tolerance in test mode (see chapter 6.2).

6.1.4 Enable the orientations (Countbox, Sortbox)

With the illuminous button LCD COUNTER, you can set the test mode so that test parts are accepted as good parts either in all taught orientations or only in the nominal orientation (Orientation 1).

Illuminous buttons	**Effect**
ON	Good parts are accepted in all taught orientations.
OFF	Good parts are accepted only in one orientation (nominal orientation). Good parts which are otherwise orientated are blown down.

6.1.5 Set counter function (Countbox, Sortbox)

In order to select the counter function, the counter display and the counter setting use the buttons COUNTER [-] and [+].

Setting	**Display [1])**	**Counter function**
Production Prod	Current counter status	**Good parts counting** All good parts are counted continuously.
Preselect PrE	Preselected nominal number	**Good parts counting with preselected number of items** All good parts are counted until the nominal number is reached. **The set nominal number or the** current counter status as desired is then shown on the LCD COUNTER.
Actual Act	Current counter status	
[1]) Display only in AUTO mode. The counter function is not activated in the operating modes TEACH and SELECT.		

Select counter function

Press briefly the buttons COUNTER [-] and [+] simultaneously. With each further pressing of the buttons you change to the next counter function. The current setting is shown on the LCD COUNTER.

Reset counter

The current counter status is usually reset by a signal from the higher-order controller (see chapter 3.4).

In order to set the counter status manually to “0”:

1. Select the setting Actual (Act) or Production (Prod).
2. Hold the buttons COUNTER [+] and [-] pressed down at the same time for at least 3 s, until the display on the LCD COUNTER switches to “---”.

Good parts counting with preselected number of items

Setting the nominal number

The nominal number of good parts is set separately for each parts type and saved automatically with the data of the parts type. Select first the parts type and the counter function Preselect:

1. Select the parts type with one of the illuminous buttons TYPE SELECT [1]...[6].
2. Press the buttons COUNTER [+] and [-] at the same time until PrE is displayed.
3. After 1.5 s the LCD COUNTER changes to represent the nominal number (presetting: *9.9.9.9* = *9999*$*10^3$).

Numerical values from 1 to *9999* are shown uncoded in the LCD. Larger numerical values are shown with addittional multipliers (points) see chapter A2, section “Representation of numbers”.

Set the nominal value as follows:

- Increase value by 1: Press COUNTER [+] briefly
  faster: Hold COUNTER [+] pressed down.
- Reduce value by 1: Press COUNTER [-] briefly
  faster: Hold COUNTER [-] pressed down.

Countbox

- Set nominal value to “1”. Hold COUNTER [+] and [-] pressed down simultaneously until the display is deleted (min. 3 s).

Sortbox

If, with the Sortbox, the nominal number of a parts type is set to “0”, the parts arriving of this type will not be counted, but blown down.

- Set nominal value to “0”. Hold COUNTER [+] and [-] pressed down simultaneously until the display is deleted (min. 3 s).

If, in AUTO mode, the current counter status is to be shown, set the counter type “Actual”.

6.2 Test mode

6.2.1 Proceed as follows

With the teach data, a reliable grading must be achieved of the parts to be checked according to orientation and qualaity (e.g. whether data of the parts have been observed). Therefore always evaluate the teach data in the test mode with regard to their reliability.

Prepare the Checkbox as described in chapter 6.1. The conveyor belt runs and the LCD TOLERANCE shows the current memory group and the tolerance in per cent.

Test procedure

Please note the following procedure:

- Use test parts which correspond approximately in their composition to the parts to be tested later in AUTO mode, i.e. good, bad and incorrecctly orientated parts.
- The test parts should be (by chance) positioned like the parts to be checked later in AUTO mode. Avoid at first particular care in placing the parts. As far as is possible, use the conveyor device intended for this purpose.
- You must check a sufficient number of parts in order to obtain a reproducible result. Show e.g. 6 parts recognized as good and 6 bad parts per orientation.
- Press the STOP button in order to interrupt or terminate the test mode.

Status display

Observe the Checkbox displays during the test procedure. When a conveyed part is registered, the status display will light up briefly.

The display TOLERANCE will light up for 1.5 seconds.

Status displays during the test procedure	
	Evaluating the test part deviation.
	Evaluating the test part orientation (if more than one orientation has been learnt).

Evaluation

The following methods or criteria will assist you in evaluating the teach data and the test results.

– Visual check chapter 6.2.2

– Checking the features chapter 6.2.3

– Checking the orientation chapter 6.2.4

– Influence of the tolerance chapter 6.2.5

If too many good parts are rejected as bad parts:

- Increase the tolerance. Please refer here to the information in chapter 6.2.5.
- Repeat the teach procedure:
  - with more sample parts,
  - using the conveyor device intended for use in automatic mode.

If the checked parts are graded reliably according to orientation and quality:

- Press the STOP button.
- Switch to the AUTO operating mode in order to start the automatic test (chapter 6.3).

If the quality check and the position recognition for the parts assortment is not sastisfactory, you can use aditional operating parameters and tools with CheckOpti, in order to optimize the test results. Please consult your technical advisor in this respect.

6.2.2 Visual check

Check the test results e.g. according to the following points of view:

– Have the orientations been recognized correctly?

– Is the grading of the parts recognized as good/bad correct? Use the sample parts to check the test parts with regard to their grading. If you have also checked faulty parts, check whether these have actually been recognized as bad.

– Use as many test parts as possible to make sure that they are correctly output at the delivery positions for good, bad or incorrectly orientated parts.

Note the explanations on the test procedure in the following chapter sections 6.2.3 and 6.2.4. If necessary, optimize the test result via the influence of the tolerance (chapter 6.2.5).

6.2.3 Checking the features

The individual features of the test parts differ from the average values of the sample part features. The Checkbox ascertains for each test part the feature which deviates the most (maximum deviation).

During the test procedure you can see this test part deviation for 1.5 seconds in the TOLERANCE display.

Display	Evaluation	Remark
100	Good part	The smaller the value, the more exact the test part corresponds to saved sample parts.
› 100	Bad part	The greater the value, the less the test part corresponds to saved sample parts.
Display range: 0 to 999		

Detailed instructions on the test part deviation (computational algorithm) can be found in chapter A.3.3.

6.2.4 Checking the orientation

During the test procedure, the Checkbox ascertains whether the orientation of the test part just scanned can be assigned to the orientations of the sample part.

⊣ . . .

The LCD TOLERANCE shows the result (after the display of the test part deviation) for 1.5 seconds.

Display	Evaluation	Meaning
‹ 100	Test part orientation can be assigned	The smaller the value, the more reliably the test part orientation can be recognized.
› 100	Test part orientation cannot be assigned clearly	The greater the value, the less reliably the test part orientation can be recognized.
Display range: 0 to 999		

6.2.5 Influence of tolerance on the test result

When a new parts type is taught, the features of all scanned parts are recorded. The values of the registered features usually differ from each other. For each feature there is then a value range (bandwidth) in which test parts are graded as “good”. By means of the tolerance setting, you can extend this bandwidth. Especially with critical conveyed parts, you should ascertain the optimum setting of the tolerance before switching to the AUTO mode. Further information on the tolerance (computational algorithm) can be found in chapter A.3.1.

Make sure that the LCD TOLERANCE shows the current memory group, e.g. 1 and the current tolerance e.g. 5 %.

Set the tolerance as follows:

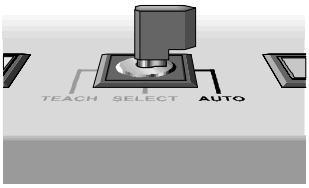
1. With the TOLERANCE [+] button, you can increase the value displayed by 1.
2. With the TOLERANCE [-] button, you can reduce the value displayed by 1.
3. Use one of the following methods:
   - Empirical setting
     Vary the tolerance so that a large number of parts are tested and corrrectly recognized as good or bad parts.
   - Setting according to test part deviation
     Select sample parts which are suitable as reference for good or bad parts. The recogition-specific features should lie where possible in the border range good/ bad. Vary the tolerance so that the following test part deviation is shown when the borderline sample parts are scanned.
     ‹ 100 for the borderline sample part “good” or
     ‹ 100 for the borderline sample part “bad”.

6.3 Automatic mode

6.3.1 Set operating mode SELECT

Prepare the Checkbox as follows:

1. Prepare test procedure (see chapter 6.1).
2. Turn key switch to AUTO.



3. If the STOP button is pressed down, press the START button.

The Checkbox then triggers a blow-free process. This is to ensure that there are no parts on the conveyor belt. The Checkbox then switches on the small parts conveyor.

1 5

The LCD TOLERANCE shows in faultless operation the current memory group and the tolerance setting for the current parts type in per cent.
The LCD COUNTER shows in faultless operation the counter status or the nominal number.

Sortbox
In automatic mode you can use the TYPE SELECT buttons to access the tolerance setting and the current counter status of each parts type of the current sorting program.

If the parts supply is interrupted, the LCD TOLERANCE will show the error message E 05.

Code	Explanation
E 05	The Checkbox has not received a conveyed part for min. 30 seconds. 1. Quit the error message with the illuminous button STATUS. 2. With manual supply of parts: supply more parts or press the STOP button. 3. With automatic supply of parts: check buffer zone and material jam.

6.3.2 Manual start/stop mode

In the operating mode AUTO, manual adjustmnt is only possible via the illuminous button STOP. Program processing is then stopped; the conveyor belt switches off. The current operating parameters are retained in the STOP status.

The automatic mode can be continued with START.

If alternating between manual operation and operation with a higher-order controller, please note the information in chapter 3.4.

6.3.3 Counter function (Countbox, Sortbox)

The display COUNTER on the Countbox/Sortbox shows in faultless operation either the continuous current counter status for good parts or the nominal number of good parts.

With STOP the current counter states are saved. With START the counting processes are continued with the saved counter states.

The switch position of the illuminous button on the LCD COUNTER influences the counter function. Depending on the switch position, only good parts in the nominal orientation or good parts in all learnt orientations will be counted.

Button	Influence on counter function
ON:	All good parts (in learnt orientations) will be counted.
OFF	Only good parts in nominal orientation will be counted.

Good parts counting with preselected number of items

The following applies to the standard design of Checkbox:
If the preset nominal number of a parts type is reached, all further good parts of that parts type will be blown down at the delivery position for superfluous good parts until the small parts conveyor is switched off. Foreign or bad parts will be further rejected at the appropriate delivery position.

Countbox
As soon as the nominal number is reached, the LCD COUNTER will show the information FULL. After the preset time, e.g. 30 s, the small parts conveyor will be switched off.

Sortbox
As soon as the nominal number is reached, the LCD COUNTER for the relevant parts type will show the information FULL. As soon as the preset nominal numbers of <u>all</u> parts types are reached, the LCD shows COUNTER FULL and flashes at 1 second intervals. After the preset time, the small parts conveyor will be switched off.

As soon as the last good part reaches the deliveryy position for foreign/bad parts, the counting process is finished. In order to start a new counting process, the Checkbox requires the signal “Start new counting cycle” from the higher-order controller. Information on the I/O dialogue can be found in chapter 3.5. Manual resetting of the counter status is only possible in the operating mode SELECT, see chapter 6.1.5.

6.3.4 Modifying operating parameters

All settings of the Checkbox are to be made in the operating mode SELECT. Please refer here to the explanations in chapter 6.1.1 ... 6.2.5.

Chapter 7

Contents

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7.1 General

The Checkbox has been designed for rough industrial environments and is distinguished by high reliability, robust structure and long service life. Special maintenance is not required.

Warning
Before undertaking cleaning or maintenance work,
switch off the following sources of energy:
– the compressed air supply
– the power supplies.

7.2 Cleaning

Cleaning the Checkbox

Remove dirt on the housing, operating elements and conveyor belt with a soft moist cloth.

Please note
With plastic parts, do not use any solvent or abrasive cleaning agent which might damage the surface. Use only non-abrasive, solvent-free cleaning agents.

Fixed cleaning intervals are not stipulated. The frequency of cleaning depends on the conditions of use at the site.

Faultless functioning of the Checkbox optics can only be guaranteed if the glass surfaces are clean and not scratched.

Clean the following if it/they is/are dirty:

– the protective screen “Camera” between the camera and the conveyor unit

– the protective screen “Lighting” between the lighting and the conveyor unit.

Please note
Make sure that the glass surfaces are not scratched; do not use abrasive cleaning agents. You will then avoid damage which could lead to malfunctioning of the Checkbox.

First remove the camera cover.

1. Switch off the compressed air and the power supplies.
2. Loosen the four fastening screws on the bottom of the camera cover.
3. Lift up the camera cover.

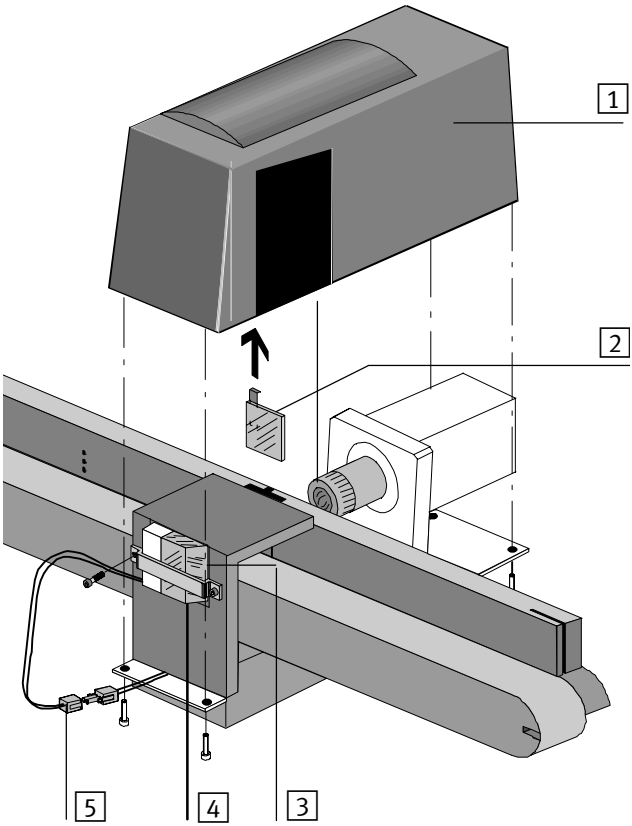
Cleaning the protective screen “Lighting”

It is not necessary to dismantle the protective screen “Lighting” in order to clean it.

Clean the glass surface above the conveyor belt:

– with clean, non-lubricated compressed air,

– with a soft moist cloth and a non-abrasive cleaning agent.



1 Camera cover

2 Protective screen “Camera”

3 Protective screen “Lighting”

4 Lighting

5 Plugs

Fig. 7/1: Protective screens

Cleaning the protective screen “Camera”

1. Loosen the locking screw next to the camera slot.
2. Pull the loose protective screen by its handle carefully upwards out of the screen slot.
3. Clean the glass surface as described above.

Refit the protective screen again after cleaning it.

1. Place the protective screen by its handle carefully back into the screen slot.
2. Tighten the locking screw next to the camera slot by hand.

Please note
Tighten the screw only by hand. You will then avoid damage to the protective screen.

Technical appendix

Appendix A

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A.1 Operating faults

A.1.1 General cause of faults

Problem	Cause	Remedy
Device cannot be switched on with START button; START and STOP buttons light up at the same time.	No power supply of the I/O module	– Internal supply: Insert the (blanking) plug preset at the factory into the connection“Controller”. – External supply: Replace the bridges in the (blanking) plug by a connection to an external power supply; check the external power supply. (Compare chapter 3.2)
Device does not function, all illuminous buttons flash	Ambient, setting, data or hardware error	1. Identify error coding in chapter A.1.2 2. Eliminate error 3. Quit with STATUS button
Good test parts are sorted out as bad parts	– Tolerance set too low – Incorrect sample part selected via TYPE SELECT	– Increase tolerance – Repeat teach procedure with more sample parts – Select (correct) sample part with TYPE SELECT buttons
Bad test parts are accepted by the device as good parts	– Tolerance set too high – Deviations not recognized by the Checkbox	– Reduce tolerance With CheckOpti: Optimize the teach data
LCD COUNTER: Display FULL: Good parts in all orientations are blown back into the small parts conveyor	The preselected counter status is reached and is not reset by the external controller	Check connection to controller
In spite of light weight, conveyed parts are not reliably blown down at the delivery points.	– Blow-down timing point incorrectly set – Suction effect due to flow resistance of conveyed part	With CheckKon: – Modify blow-down timing point – Modify nozzle geometry

Problem	Cause	Remedy
Conveyed parts facing wrong way at end of conveyor belt	– Conveyed parts are turned the wrong way due to unevenness of the system edge or – Conveyed parts are turned the wrong way when previous/following parts are blown down.	1. Close the compressed air restrictor. 2. Observe the conveyed parts at the end of the conveyor belt: – Turned: Replace system edge; open compressed air restrictor. – Not turned: Open compressed air restrictor; reduce the blow-down duration with CheckKon or increase the distance between conveyed parts.
When a new sample part has been learnt, good test parts are sorted out as bad parts	Teach procedure interrupted with STOP button	1. Repeat teach procedure for new sample part 2. Conclude teach process: Do not press the STOP button, but use the key switch to switch to operating mode SELECT.
Blow-down timing point/ duration of the Checkbox is not correct. Test part deviation is shown unusually long on LCD TOLERANCE.	Checkbox runs in diagnostic mode (setting via CheckKon or CheckOpti)	– With CheckKon/CheckOpti: Switch from diagnostic mode to operating mode

A.1.2 Error messages

Error messages are shown on the LCD TOLERANCE. They must be quitted before the Checkbox can start again:

1. First eliminate the cause of the fault.
2. Then actuate the (flashing) button STATUS.

Code	Cause	Remedy
Ambient error		
E 01	Fault in the compressed air supply – No compressed air – Pressure too low – Fluctuations in pressure in supply network	– Check compressed air supply – If necessary, insert a pressure reservoir between the Checkbox and the compressed air network.
E 02	Optical faults – Lighting dirty or defective; glass cover of camera or camera optics dirty – Camera optics misted due to considerable difference in temperature of Checkbox/ environment – Blockage in front of the optical unit. – Camera registers lower range of conveyor belt – Max. parts length exceeded	– Remove dirt with a soft cloth and non-abrasive cleaning agent or blow down from the glass cover with non-lubricated compressed air. – Avoid large differences in temperature. – With CheckKon: Corrrect the setting of the picture limits. Increase exposure time or ratio encoder frequency/line frequency.
E 03	Camera fault	– Check camera connection. Disconnect from the mains supply before loosening the camera connection. – Replace the camera cable
E 04	System recognizes too many incorrect conveyed parts: > 75 % of the last 20 parts were graded as bad parts	– Check the selection of the sample part type – Increase tolerance

Code	Cause	Remedy
E 05	Material blockage: No conveyed part for at least 30 seconds (time varies depending on Checkbox configuration)	Fill up small parts conveyor.
E 06	Maximum permitted parts length exceeded	– With CheckKon: Set parameter “Max. parts length” correctly. – Set the device so that the parts follow along at a recognizable distance.
E 07	Optical faults: Reduced brightness	Clean the glass covers of the lighting and of the camera.
E 08	Conveyor belt blocked or encoder does not turn	1. Press the STOP button. 2. Remove test parts which have become trapped. Check units added to the conveyor unit; remove obstructions on the conveyor belt. 3. Check that the encoder functions correctly. 4. Press the START butto.
E 09 **E 10**	Internal I/O module overloaded	1. Press the STOP button. 2. Check whether external outputs are loaded with a current too high. 3. Press the START button. Or contact the Festo after-sales service.
E 12	No power supply on I/O module	– Check the blanking plug on the connection for the higher-order controller. – Operation with electrical isolation: Checking the external supply voltage.
E 14	Belt speed for the set ratio encoder frequency/line frequency of the camera (F_{EZ}-value) too high	– Reduce belt speed – With CheckKon: Adapt F_{EZ}-value

Code	Cause	Remedy
Recognition errors		
E 20	The nominal orientation cannot be distinguished from other orientations, because e.g. – parts orientations were swapped during the teach process by mistake or – the nominal orientation is too similar to other orientations.	• Repeat the teach procedure. Make sure that the sample parts are positioned in accordance with the selected orientation. • Optimize the teach data with the CheckOpti software. **Countbox, Sortbox:** If it is not necessary to distinguish the nominal orientation: 1. Turn the key switch to TEACH. 2. Switch on the illuminated button on the LCD COUNTER. 3. Repeat the teach procedure.
Recognition error - Sortbox		
E 21	The taught sample part cannot be distinguished clearly from other sample parts because e.g. – the sample part is identical to the parts type of another TYPE SELECT memory location. – a different orientation of the sample part has been saved on another TYPE SELECT memory location.	• Repeat the complete teach procedure. • Optimize the sorting procedure with the CheckOpti software.

Code	Data error	Remedy
E 40	Teach data are not clear. When the device is switched on again, the saved teach data are no longer OK.	– Repeat the teach process. – Check environment on non-CE-conform devices. – If this occurs frequently and when other devices are connected to the Checkbox: Operation with external power supply of the I/O module, see chapter 3.2.
E 41	Controller has lost system parameters	– Load system parameters again from internal safety memory: 1. Switch off Checkbox via mains switch. 2. Press the TYPE SELECT [1] button and hold pressed down while the mains switch is switched on. 3. Release the TYPE SELECT [1] button after 2 seconds. During the load procedure all the illuminous buttons light up briefly one after the other from left to right (running light). – With CheckKon: Load system parameters again. – Or contact the Festo after-sales service.
E 42	Controller has lost configuration part of the teach data	– Load system parameters again from internal safety memory: 1. Switch off Checkbox via mains switch. 2. Press the TYPE SELECT [1] button and hold pressed down while the mains switch is switched on. 3. Release the TYPE SELECT [1] button after 2 seconds. During the load procedure all the illuminous buttons light up briefly one after the other from left to right (running light). – With CheckKon: Load the teach data again. – Or contact the Festo after-sales service.
E 43	Teach data are not compatible. Teach data are not compatibly organised for the Checkbox used.	Use compatible teach data format. Repeat the teach process.

If a hardware error message >= E 60 occurs, please contact Festo after-sales service.

Error situation	Cause	Remedy
...E 01, although pressure in the compressed air network is apparently constant.	Brief fluctuations in pressure in the compressed air network, e.g. by large volume consuming devices.	If necessary, insert a pressure reservoir between the Checkbox and the compressed air network.
...FULL on LCD TOLERANCE, although the buffer zone is not full. Good parts in all orientations are blown back into the small parts conveyor.	– (Blanking) plug missing at connection “Sensors” – Bridges missing at connection “Controller” – Control cable defective or incorrect pin assignment at connection “Sensors”.	– Operation without buffer zone sensors: Insert blanking plug and check bridges. – Operation with buffer zone sensors: Check control cable and pin assignment.
...E 02, although length of conveyed part is shorter than max. permitted length.	– Conveyed part has lots of holes or is semi-transparent. – Speed of conveyor belt has been modified.	With CheckKon: - Increase belt speed - Increase exposure time - Vary grey value threshold - Limit camera angle of vision - Activate filter function
...E 02 occurs in the morning although the Checkbox worked perfectly the day before.	– High fluctuations in temperature for example between day and night. – Conveyor belt has been replaced	With CheckKon: Setting the lower picture limit
...E 04 although only a small number of bad parts passes the test procedure.	Moving particles of dirt on the conveyor belt.	– Clean the conveyor belt with compressed air. – Install a cutting device in front of the conveyor belt.

A.2 Status displays on the control panel

Illuminous buttons

Status	Button	Meaning
Continuous lighting	TYPE SELECT [1] [2] [3] [4] [5] or [6]	Display of the selected memory location
	START	Controller is switched on
	STOP	Controller is switched off
		Test part is passed as a good part in all taught orientations.
Flashes	STATUS	New part passes the camera.
	TYPE SELECT [1] to [6] STATUS STOP	Error message An error code also appears in the LCD TOLERANCE, see Appendix A.1.2.

Checkbox with encoder

In order to display the belt speed, press the STATUS button in the select mode. The LCD TOLERANCE then shows the belt speed of the conveyor unit in [mm/s].

LCD displays

The grey shaded fields mark the main displays. Main displays are shown continuously; the remaining (additional) displays are only shown for a brief period due to an event or an operating status. The counter function is not active in the operating mode TEACH; the LCD COUNTER does not show anything.

Switch on

Display TOLERANCE

LCD	Meaning
I 3.0	Letter for Checkbox design I(dent), C(ount) or S(ort) and version status of the operating system. Example: Identbox version 3.0
6 E	Number of memory groups or sorting programs (Sortbox) and also letter E with system setting “with encoder”. Example: 6 memory locations, encoder
1024	System setting of the camera resolution. Example: 1024 pixels

Teach mode

Display TOLERANCE

Display	Meaning	Values
u 1	Selection of the memory group of the parts type/sorting program Example: Memory group 1	Corresponding to the Checkbox configuration
C . . .	Characteristic scatter < 10: Sample parts are very similar in all features. > 30: Large scatter of at least one feature.	0...999
= . . 1	Orientation of the sample parts during the teach procedure.	1...8
E . .	Error code for system error.	01...99 Details in chapter A.1.2
tool	Memory address occupied – with measuring tool – or with optimized teach data (CheckOpti).	

Select mode

Display TOLERANCE:

Display	Meaning	Values
U 1	Selection of the memory group of the parts type / sorting program	
1 10	Tolerance value for the current parts type 1st. number: Parts type or sorting program 2nd. number: Tolerance in %	1st. number: corresponding to the Check-box configuration 2nd. number: 0...20
F . . .	Test part deviation: The smaller the value, the more exact the test part corresponds to saved sample parts. ≤ 100: Good part > 100: Bad part	0...999
4 . . .	The smaller the value, the more reliably the test part orientation can be recognized. < 100: Test part orientation can be assigned > 100: Test part orientation cannot be assigned clearly	0...999
E . .	Error code for system error.	01...99 Details in chapter A.1.2

Display COUNTER

Display	Meaning	Range
Prod	Counter function without switching off Option: Production counter	---
PrE	Counter function with switching off Option: Nominal value of good parts	---

Display	Meaning	Range
Act	Counter function with switching off Option: Current counter	---
500	Counter function with switching off Option: Nominal value of good parts	0...9999 * 10^3

Teach mode

Display TOLERANCE

Display	Meaning	Range
1 10	Tolerance value for the current parts type/sorting program 1st. number: Parts type or sorting program 2nd. number: Tolerance in %	2nd. number: 0...20
FULL	Status of buffer zone (signal from buffer zone sensor)	---
E ..	Error code for system error	01...99 Details in chapter A.1.2

Display COUNTER

Display	Meaning	Range
1234	Corresponding to the selected option of the counter function: **Without switching off** – Production counter **With switching off** – Nominal value of good parts or – Current counter	0...9999 * 10^3
FULL	Preselected counter reading reached	---

Number representation

Display COUNTER
As from value *9999* the 4-position LCD shows numerical values with additional decimal points (multipliers). The values shown must be multiplied by the power of 10 for each decimal point.

Numerical value	**Multiplication**	**Number**
9 9 9 9		*9999*
1.0 0 0	1000 x 10^1	10000
1.0.0 0	1000 x 10^2	100000
1.0.0.0	1000 x 10^3	1000000

A.3 Calculation examples

A.3.1 Bandwidth and tolerance

Bandwidth B specifies the extent to which the value of the feature may vary upwards or downwards.
Tolerance T specifies the per cent increase in the bandwidth of each feature, related to the average value of the feature.

$$C_{max\,tol} = C_{max} + A \times \frac{T}{100}$$

$$C_{min\,tol} = C_{min} - A \times \frac{T}{100}$$

$$B = C_{max\,tol} - C_{min\,tol}$$

$$= C_{max} - C_{min} + \frac{2 \times T \times A}{100}$$

$$\rightarrow T = \frac{B - (C_{max} - C_{min})}{2 \times A} \times 100$$

O	Average value of the feature
B	Bandwidth
C_{max}	Feature - maximum
$C_{max\,tol}$	Upper limit of bandwidth incl. tolerance
C_{min}	Feature - minimum
$C_{min\,tol}$	Lower limit of bandwidth incl. tolerance
T	Tolerance

Example

Ascertaining the bandwidth for the feature “Length” of a conveyed part with a set tolerance of 5 % (display on the LCD TOLERANCE).

Conveyed part lengths [mm] for 5 sample parts ascertained during the teach procedure: 60 60 61 65 60

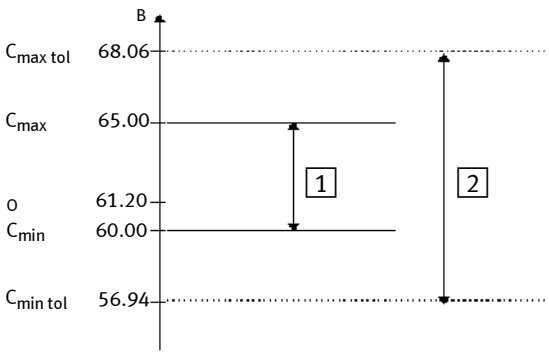
Therefore:

A	= 61.2 mm	Average value of the length
C_{max}	= 65 mm	Length - maximum
C_{min}	= 60 mm	Length - minimum
T	= 5 %	Tolerance

$$B = C_{max} - C_{min} + \frac{2 \times T \times A}{100}$$

$$B = (65 - 60) + \frac{2 \times 5 \times 61.2}{100}$$

$$B = 11.12$$



1 Bandwidth of conveyed part length

2 Bandwidth with 5 % tolerance

Result: All conveyed parts with a length of 57...68 mm are classified as good parts. The Checkbox ascertains appropriate value ranges for each feature.

A.3.2 Scatter of characteristics

$$S = \frac{C_{max} - C_{min}}{A} \times 100\ \%$$

O	Average value of the feature
C_{max}	Feature - maximum
C_{min}	Feature - minimum
S	Characteristic scatter

Example

Ascertaining the characteristic scatter for the feature “Length” of a conveyed part.

The following values are taken from the example “Bandwidth”:

A	= 61.2	Average value of the length
C_{max}	= 65	Length - maximum
C_{min}	= 60	Length - minimum

$$S = \frac{65 - 60}{61.2} \times 100\ \%$$

$$S = 8.2\ \%$$

A.3.3 Feature deviation

Ascertaining deviation D for C ‹ A

$$D = \frac{C_{actual} - A}{C_{min\ tol} - A} \times 100\ \%$$

O	Average value of the feature
C_{actual}	Current feature measurement
$C_{min\ tol}$	Lower limit of bandwidth incl. tolerance
D	Feature deviation

Example

Ascertaining the deviation for the current feature “Length” of a conveyed part $C_{actual} = 61$ (C ‹ A).

The following values are taken from the example “Bandwidth”:

A	= 61.2	Average value of the length
$C_{min\ tol}$	= 56.94	Length - lower value
C_{actual}	= 61	Length - current value

$$D = \frac{61 - 61.2}{56.94 - 61.2} \times 100\ \%$$

$$D = 4.7\ \%$$

Ascertaining deviation D for C ‹ A

$$D = \frac{C_{actual} - A}{C_{max\ tol} - A} \times 100\ \%$$

O	Average value of the feature
C_{actual}	Current feature measurement
$C_{max\ tol}$	Upper limit of bandwidth incl. tolerance
D	Feature deviation

Example

Ascertaining the deviation for the current feature “Length” of a conveyed part C_{actual} = 64 (C ‹ A).

The following values are taken from the example “Bandwidth”:

A	= 61.2	Average value of the length
$C_{max\ tol}$	= 68.06	Length – upper value
C_{actual}	= 64	Length - current value

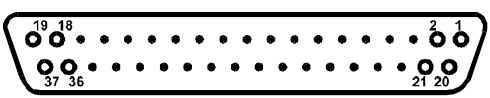
$$D = \frac{64 - 61.2}{68.06 - 61.2} \times 100\ \%$$

$$D = 41.8\ \%$$

A.4 Pin assignment

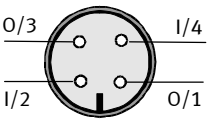
Connector socket “Controller” on the Checkbox			
Pin	Identbox	Countbox	Sortbox
O/1	Actuator 7	Actuator 7	Actuator 7
O/2	Identbox mode 0	Countbox mode 0	Sortbox mode 0
O/3	Error status 1	Error status 1	Error status 1
I/4	Do not connect	Do not connect	Buffer zone sensor 6
I/5	Do not connect	Do not connect	Buffer zone sensor 4
I/6	Buffer zone sensor 2	Buffer zone sensor 2	Buffer zone sensor 2
O/7	Reference voltage + 24 V	Reference voltage + 24 V	Reference voltage + 24 V
I/8	Ext. Type preselect bit 4	Ext. Type preselect bit 4	Do not connect
I/9	Ext. Type preselect bit 2	Ext. Type preselect bit 2	Ext. Sorting program preselect bit 2
I/10	Ext. Type preselect bit 0	Ext. Type preselect bit 0	Ext. Sorting program preselect bit 0
O/11	Actuator 4	Actuator	Actuator 4
O/12	Actuator 2	Actuator 2	Actuator 2
O/13	Do not connect	Nominal number reached	Nominal numbers of all parts types reached
O/14	Identbox mode 1	Countbox mode 1	Sortbox mode 1
I/15	Ext. I/O supply GND	Ext. I/O supply GND	Ext. I/O supply GND
O/16	Ext. I/O supply GND	Internal voltage GND	Internal voltage GND
O/17	Conveyor belt	Conveyor belt	Conveyor belt
O/18	Cleaning valve	Cleaning valve	Cleaning valve
19	Not assigned	Not assigned	Not assigned
O/20	Actuator 6	Actuator 6	Actuator 6
O/21	Error status 2	Error status 2	Error status 2
O/22	Error status 0	Error status 0	Error status 0

Pin	Identbox	Countbox	Sortbox
I/23	Do not connect	Do not connect	Buffer zone sensor 5
I/24	Do not connect	Do not connect	Buffer zone sensor 3
I/25	Buffer zone sensor 1	Buffer zone sensor 1	Buffer zone sensor 1
O/26	Reference voltage GND	Reference voltage GND	Reference voltage GND
I/27	Ext. Type preselect bit 3	Ext. Type preselect bit 3	Ext. Sorting program preselect bit 3
I/28	Ext. Type preselect bit 1	Ext. Type preselect bit 1	Ext. Sorting program preselect bit 1
O/29	Actuator 5	Actuator 5	Actuator 5
O/30	Actuator 3	Actuator 3	Actuator 3
O/31	Actuator 1	Actuator 1	Actuator 1
I/32	Do not connect	Start new counting cycle	Start new counting cycle
I/33	Remote start	Remote start	Remote start
I/34	Ext. I/O supply + 24 V	Ext. I/O supply + 24 V	Ext. I/O supply + 24 V
O/35	Internal voltage + 24 V	Internal voltage + 24 V	Internal voltage + 24 V
I/36	Ext. Pressure sensor 1)	Ext. Pressure sensor 1)	Ext. Pressure sensor 1)
O/37	Conveyor unit	Conveyor unit	Conveyor unit



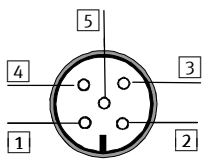
1) As standard the built-in pressure sensor of the Checkbox is monitored. If an external pressure sensor is to be connected via I/36, the Checkbox configuration must be adapted accordingly. Please consult the Festo after-sales service.

Connector socket “Sensors” on the Checkbox

O/1	24 V DC Reference voltage for sensors	
I/2	Buffer zone sensor 2	
O/3	0 V Reference voltage for sensors	
I/4	Buffer zone sensor 1	

The sensor inputs are negative-switching (normally-closed).
If 24 V DC is applied, the small parts conveyor will be switched on.
As an option, direct connection with a Festo DUO cable is also possible. Cable designation signal x (= I/1), signal x+1 (= I/2).

Connector plug “Small parts conveyor” on the Checkbox

1	Normally-open contact 1	
2	Normally-open contact 2	
3 4 5	Not assigned	
Contact loading 48 V/100 mA		

A.5 Technical specifications

General operating specifications

Checkbox operating specifications	
General	
Temperature for operation, storage, transport	+ 10 ... + 50 °C non-condensing
Electromagnetic compatibility (EMC)	EN 61000-2-3
Protection against electric shock hazard	Protective earthing
Degree of protection	IP54
Pneumatics	
Compressed air quality	– Non-lubricated – Dried – Filtered with filter 40 µm
Compressed air supply	4...6 bar overpressure
Electric components	
Power supply (self setting)	85...264 V / 50...60 Hz via a backup fuse of 1 A (slow-blowing) in the mains switch
Power consumption	Max. 150 VA

Conveyor and test output

Conveyor and test output			
Camera resolution			
Conveyor unit up to	⌀ 10 mm	⌀ 30 mm	⌀ 80 mm
Resolution	2/100 mm	1/10 mm	1/10 mm
Belt speed			
Speed can be set	200 mm/s 100...300	300 mm/s 100...400	300 mm/s 100...400
Examples of conveyor rate Belt speed 300 mm/s			
M3x25 screws in correct position for mounting			4...5 items/s
Axes Ø 18x25 mm for quality check			8 items/s
Bolts Ø 5x50 mm tested and in correct position			2 items/s
The conveyor rate depends on the size of the component, the number of orientations and the belt speed.			

Dimensions, weight

Controller: Dimensions and weight		
Height	[mm]	208
Width	[mm]	329
Depth	[mm]	204
Weight	[kg]	6

Conveyor unit: Dimensions and weight				
Forparts up to		⌀ 10 mm	⌀ 30 mm	⌀ 80 mm
Conveyor unit with 2 blow-down positions				
Height	[mm]	154	142	254
Width	[mm]	300	580	580
Depth	[mm]	295	291	432
Weight	[kg]	4	7	12
Conveyor unit with 4 blow-down positions				
Height	[mm]	154	142	254
Width	[mm]	410	730	730
Depth	[mm]	295	291	432
Weight	[kg]	5	8.5	16
Conveyor unit with 6 blow-down positions				
Height	[mm]	154	142	254
Width	[mm]	520	880	930
Depth	[mm]	295	291	432
Weight	[kg]	6	10	16

Conveyor unit dimensions
Rotation-symmetric or pre-orientated parts

Dimensions		**Conveyor unit for conveyed part**		
		⌀ 10 mm	⌀ 30 mm	⌀ 80 mm
Length [1)]	[mm]	3...50	3...80	5...80
Diameter	[mm]	0.5...10	3...30	3...80
[1)] Further lengths on request				

A.6 Accessories

Accessories	
Encoder	
Buffer zone sensors	
Stop panel, stainless steel	
Replacement conveyor belt	
Knife-edge deflector roller (for conveyor unit ⌀ 30 mm)	
Power module for controlling the conveyor unit	
Cables	
Diagnostic cable/software	order no. 150 268
Cable for buffer zone sensors – Adapter cable (Duo cable) – **Extension cable 2.5 m** – Extension cable 5 m	 order no. 18 685 **order no. 18 684** order no. 18 686
Hybrid cable (for connecting the control unit with the conveyor unit) in various lengths	
Spare plug	
5-pin spare plug for connecting the small-parts conveyor	
4-pin spare plug for buffer zone sensors	
37-pin spare plug for a higher-order controller	
37-pin spare plug for a higher-order controller with 5 m cable length	
Mounting plates for build-on parts to the conveyor unit	
Mounting plate, supply	
Mounting plate, exit	

Brief instructions

Appendix B

Contents

B. Brief instructions B-1

Procedure

Commissioning

Before switching the Checkbox on you must carry out the following steps:

1. Fit the modules
2. Connect the compressed air supply
3. Connect the power supply
4. Connect the plugs provided (see table “Operating requirements”):
   - The 4-pin plug “Sensors” for connecting the buffer zone sensors 1...2 or for wiring unused sensor inputs with the reference voltage.
   - The 37-pin Sub-D plug “Controller” for connecting the power supply for the I/O modules and for connecting buffer zone sensors or for wiring unused sensor inputs with the reference voltage.

Switching on

Switch on the Checkbox as follows:

1. Actuate the mains switch on the connection side of the controller.
2. Start the Checkbox by pressing the green illuminated START button on the control panel of the controller. The conveyor belt runs. The START button is lit continuously.

Operating modes

Use the key switch to start the relevant operating mode of the Checkbox:

- TEACH: for carrying out the teach procedure.
- SELECT: for saving the teach data, setting the operating parameters and for checking the conveyed parts in test mode.
- AUTO: for checking the conveyed parts in automatic mode.

Switching off

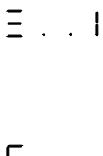
Switch off the Checkbox as follows:

1. Press the STOP button. The STOP button is lit continuously. The conveyor belt remains at a stand.
2. Switch off the mains switch on the connection side of the controller.

Identbox, Countbox: Operating requirements
Operation without buffer zone sensors
• Screw the plug “Sensors” wired at the factory into the connection “Sensors”. • Also insert the plug “Controller” for the power supply to the I/O modules into the connection“Controller”.
Operation with 1 buffer zone sensor at the connection “Sensors”
• Use the plug “Sensors” - without the bridge fitted at the factory - with the sensor connected at sensor input 1 - with unused input 2 bridged with input 1 Screw the plug into the connection “Sensors”. • Also insert the plug “Controller” wired at the factory into the connection “Controller”.
Operation with two buffer zone sensors at the sensors connection
• Use the plug “Sensors” - without the bridge fitted at the factory - with sensors connected at both sensor inputs. Screw the plug into the connection “Sensors”. • Also insert the plug “Controller” wired at the factory into the connection “Controller”.

Sortbox: Operating requirements
... without buffer zone sensors
• Screw the plug “Sensors” wired at the factory into the connection “Sensors”. • Also insert the plug “Controller” wired at the factory into the connection “Controller”.
... with 1 buffer zone sensor at the connection “Sensors”
• Use the plug “Sensors” - without the bridge fitted at the factory - with the sensor connected at sensor input 1 - with unused input 2 connected to 24 V DC. Screw the plug into the connection “Sensors”. • Also insert the plug “Controller” wired at the factory into the connection “Controller”.
... with two buffer zone sensors at the connection “Sensors”
• Use the plug “Sensors” - without the bridge fitted at the factory - with sensors connected at both sensor inputs Screw the plug into the connection “Sensors”. • Also insert the plug “Controller” wired at the factory into the connection “Controller”.
... with more than two buffer zone sensors at the connection “Sensors”
• Use the plug “Controller” if you wish to connect more than two buffer zone sensors - without the bridges fitted at the factory between the sensor inputs and 24 V DC - with sensors connected at the appropriate sensor inputs - with unused sensor inputs connected to 24 V DC Screw the plug into the connection “Controller”. • Use the plug “Sensors” at the connection “Sensors” - without the bridges fitted at the factory between the sensor inputs and 24 V DC. Screw the plug into the connection “Sensors”.

Teach procedure

Step	LCD TOL.	Checkbox
Set operating mode TEACH		Switch on operating mode TEACH with the key switch. The TOLERANCE display shows memory group 1.
Addressing teach data		1. Set the desired memory group with the keys [+] and [-] on the TOLERANCE display. 2. Determine the number of the parts type with one of the TYPE SELECT keys [1]...[6]. [1)]
Scanning sample parts		Show at least six sample parts in the current orientation. 1. Scan sample parts in orientation 1. 2. Observe characteristic scatter It is optimum when the value changes at first very much, then remains almost constant. 3. Set the next orientation with the key TOLERANCE [+]. 4. Scan sample parts in the new orientation.
Saving teach data		Switch to the operating mode SELECT with the key switch.

[1)] The sorting program is defined for the Sortbox when a memory group is assigned.

Test procedure

Step	LCD TOL.	Identbox	Countbox	Sortbox
Set operating mode SELECT	1 5	• Switch on operating mode SELECT with the key switch. The LCD TOLERANCE shows the current memory group and the tolerance in per cent.		
Set the operating parameters	L 1	Load the teach data (parts type): 1. Press the keys TOLERANCE [+] and [-] at the same time. 2. Select the memory group with TOLERANCE [+] or [-]. 3. Select the parts type with TYPE SELECT [...].		Load teach data (sorting program): 1. Press the keys TOLERANCE [+] and [-] at the same time. 2. Select the memory group with TOLERANCE [+] or [-].
	1 5	• Set the tolerance with TOLERANCE [+] or [-]; standard setting 5 %; min. 1 %	• Set the tolerance with TOLERANCE [+] or [-]; standard setting 5 %; min. 1 % • Enable the orientations (all orientations) or block (only the nominal orientation) with the illluminous button on the LCD COUNTER. • Set the counter function or display: Press COUNTER [+] and [-] at the same time. Set the nominal number: COUNTER [+] or [-].	
Test mode	4 . . . F . . .	Supply several test parts of the current parts type (good – bad – incorrectly orientated). LCD TOLERANCE shows briefly one after the other – the test part deviation – the position deviation. Evaluation: 1. Visual check, check of the blow-down positions and the blow-down procedure 2. Max. feature deviation of the test part (test part deviation < 100 ?) 3. Check of orientation (position deviation < 100 ?) 4. Check influence of the tolerance		

Step	LCD TOL.	Identbox	Countbox	Sortbox
Automatic mode	1 5	• Switch to the operating mode AUTO with the key switch.		
		The LCD TOLERANCE shows the current memory group and the tolerance in per cent.	The LCD TOLERANCE shows the current memory group and the tolerance in per cent. The LCD COUNTER shows in faultless operation the counter status or the nominal number.	

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Appendix C

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